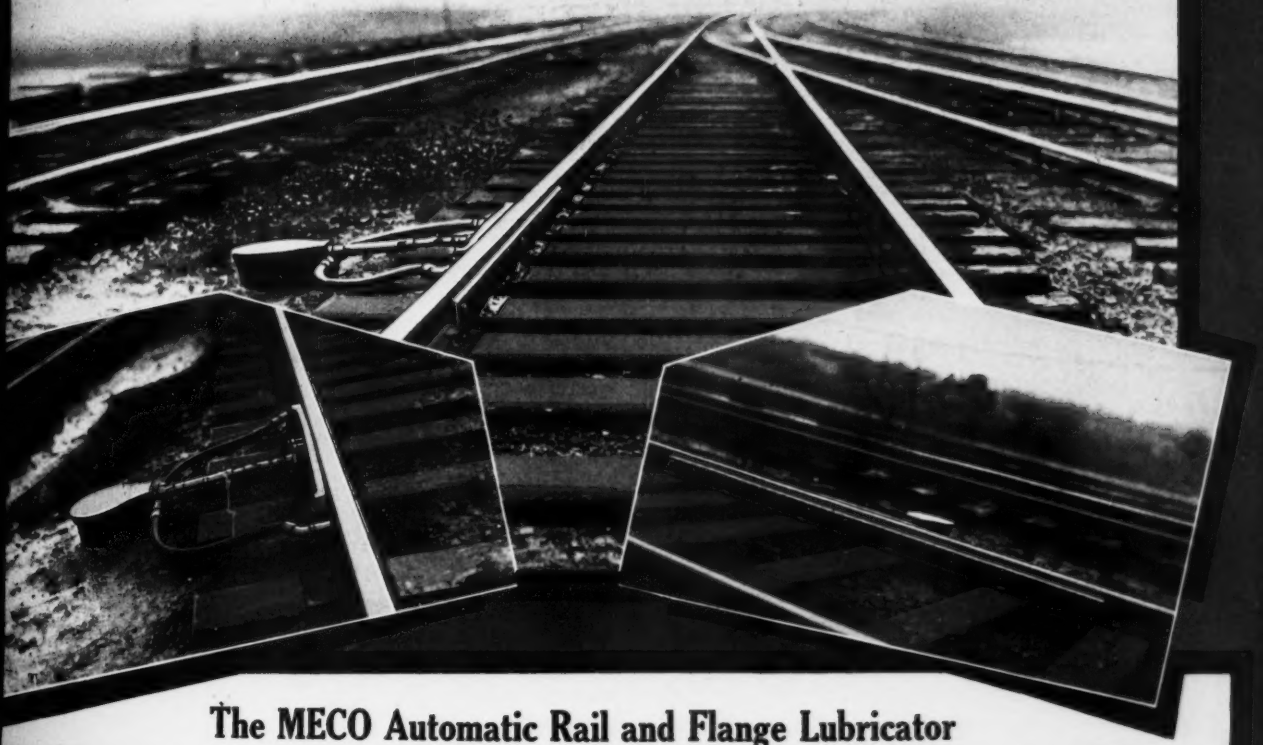
MAY, 1929

Railway Engineering and Maintenance

CURVE RAIL LIFE MULTIPLIED



The MECO Automatic Rail and Flange Lubricator

Reduces curve wear

Prevents Derailments

Reduces track gauging work on curves

Permits greater speed and higher train tonnage ratings

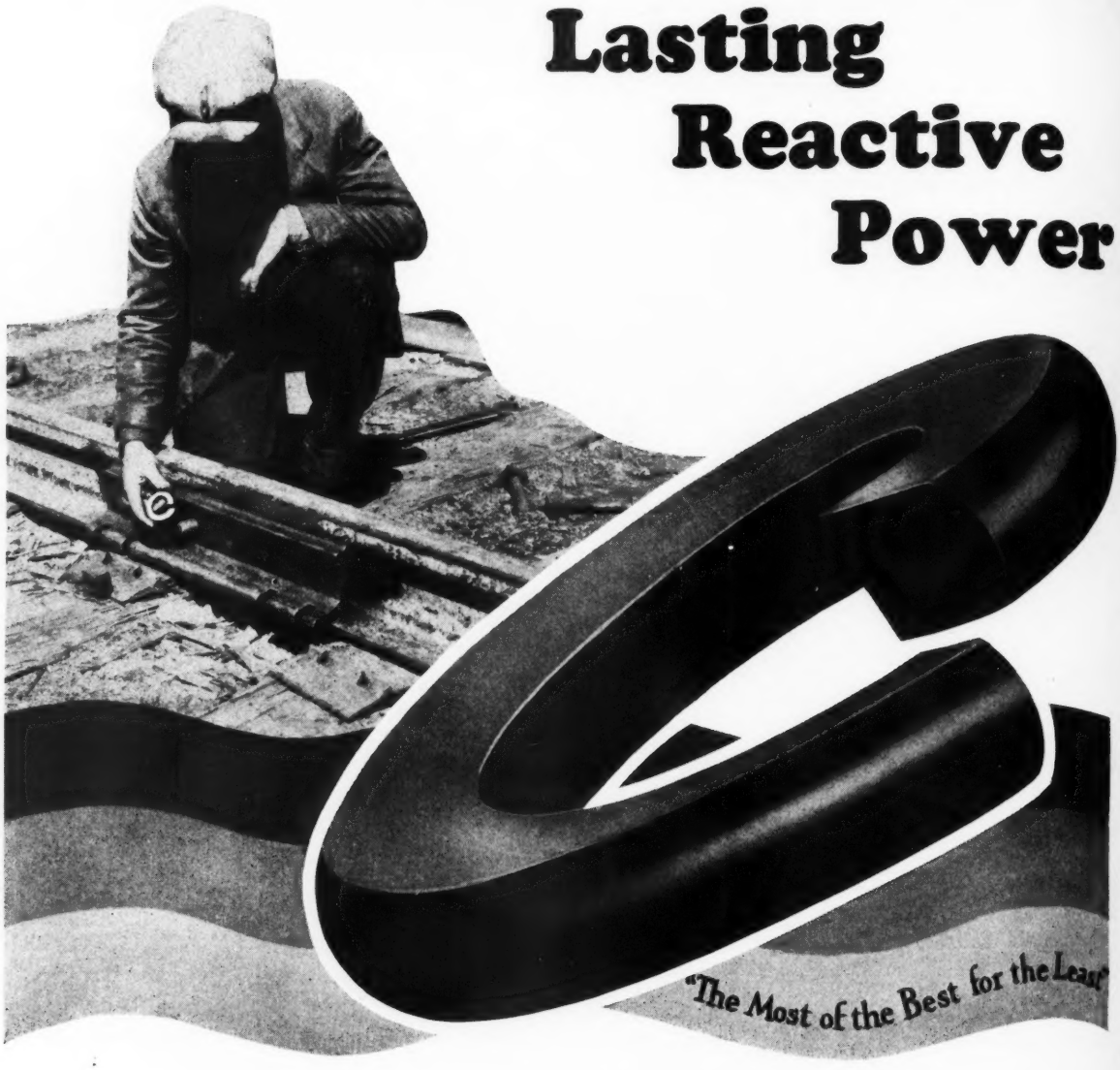
Unaffected by weather or foreign substances

MAINTENANCE EQUIPMENT COMPANY

Railway Exchange Bldg., Chicago, Ill.

NEW YORK CLEVELAND SAN FRANCISCO ST. LOUIS

Lasting Reactive Power



EVERY comparison of spring washer performance must be a comparison of reactive forces—not so much by the pressures recorded on the laboratory testing machine as by the appearance after a year of service.

Tests of this nature are constantly being conducted by railroads throughout the country and it is significant that there is an ever growing demand for HY-CROME.

Railroads have discovered that the great reactive power of HY-CROME is not affected by time, heavy traffic or climatic conditions.

Why waste time and money on *useless fillers* when HY-CROME offers permanent security? Its non-fatiguing qualities never tire and one per track bolt is sufficient no matter how severe the operating conditions.

The Reliance Manufacturing Co.
Massillon, Ohio

Address Dept. M. E.

HY-CROME

RAILWAY ENGINEERING AND MAINTENANCE
Published monthly by Simmons-Boardman Publishing Co., at 105 W. Adams St., Chicago. Subscription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered as second class matter January 13, 1916, at the postoffice at Chicago, Illinois, under the Act of March 3, 1879.
Alphabetical Index to Advertisers, Page 66 Classified Index to Advertisers, 62-64

PERFECT SEATING

That Assures Correct Gauge

THIS cross section shows how uniformly the Lundie Plate seats itself on the tie.

The plate compresses without cutting a single fibre of the tie and develops a hardened glazed wear resisting surface.

The bottom of the tie plate provides a series of at least 10 rounded steps of resistance, giving tremendous holding power against plate movement and consequent spreading of track. All this is accomplished without sacrificing any tie life through the use of destructive cutting projections.

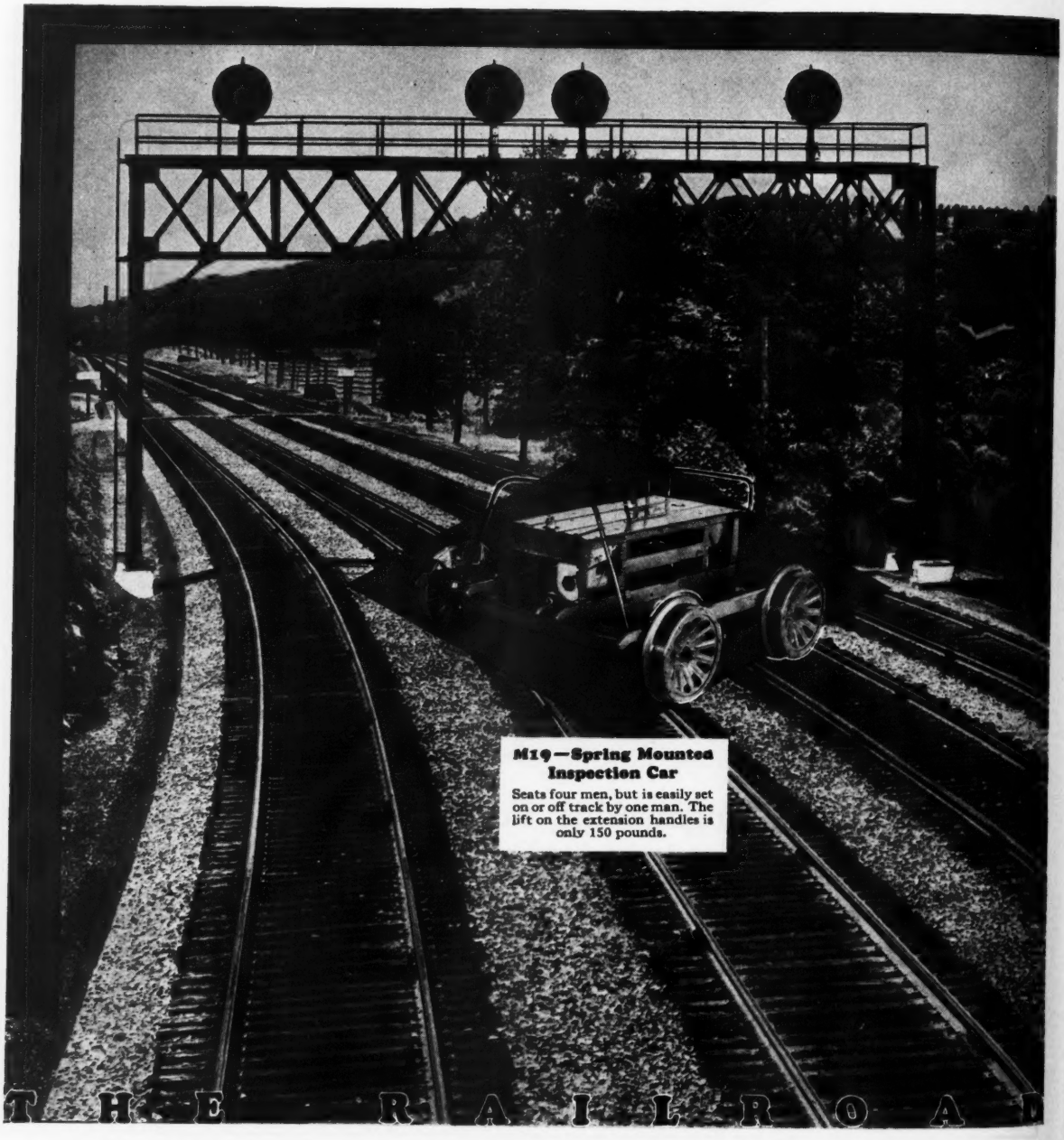
Now, when tie renewals are in full swing, is the time to pave the way for big future economies. Protect these ties with Lundie Tie Plates. They not only maintain correct gauge, cant the rail at the desired inclination, but protect the ties against mechanical destruction and prolong their life in track.

The Lundie Engineering Corporation

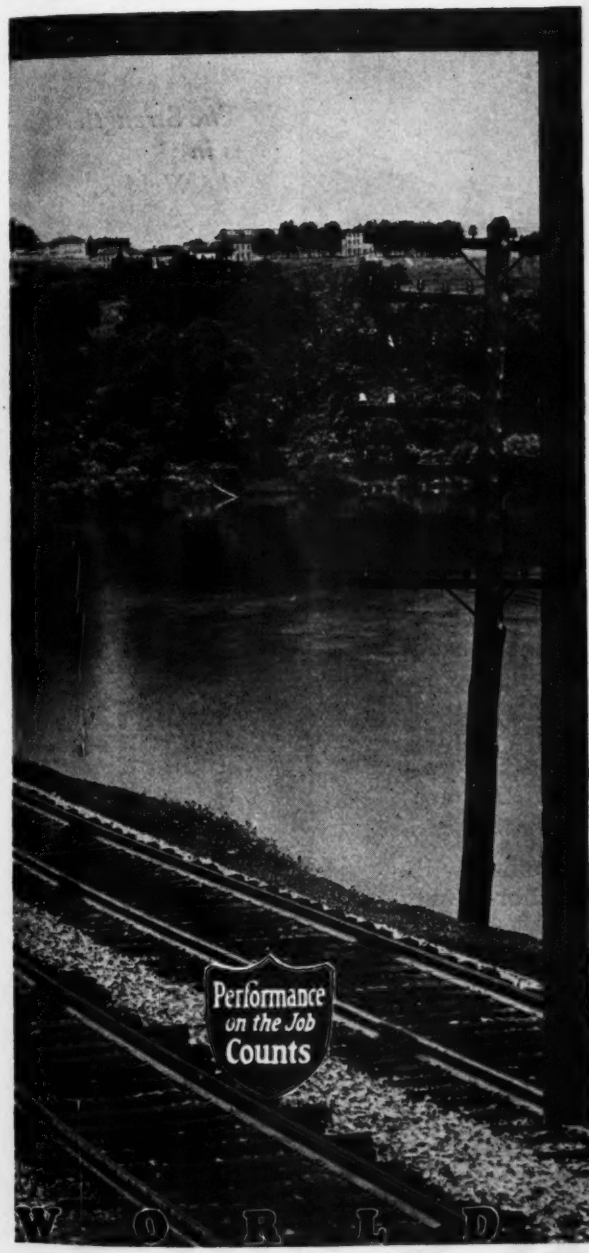
285 Madison Avenue, New York
166 West Jackson Boulevard, Chicago

LUNDIE TIE PLATE

Fairmont RAILWAY MOTOR


M19—Spring Mounted Inspection Car
Seats four men, but is easily set on or off track by one man. The lift on the extension handles is only 150 pounds.
THE RAILROAD

AND Mudge CARS



CONCENTRATION

Doing one thing well! Thought, purpose, effort—all concentrated on the one task—Railway Motor Cars!

Engineering skill, materials and manufacture—all devoted to helping the railroads in their gigantic task of linking the "magnificent distances" of America!

This concentrated effort enables the Fairmont organization to work in close touch with railway maintenance men and take care of their individual problems.

This broad experience, including every possible condition of motor-car service, has made the Fairmont line the dominant one in the field—over half of all the motor cars in use are Fairmont Products.

FAIRMONT RAILWAY MOTORS, INC.

General Offices: FAIRMONT, MINN.
General Sales Offices: CHICAGO, ILL.
Branch Offices: New York City Washington, D. C. St. Louis San Francisco New Orleans Winnipeg, Can.
BALDWIN LOCOMOTIVE WORKS, Foreign Representative

Fairmont and Mudge Products

SECTION MOTOR CARS
A2—M2—S2—M14—WS2

INSPECTION MOTOR CARS
E14—C1—M19—MM9

WEED MOWERS AND DISCERS
M24—M23

WEED BURNERS
B(M27)—C(M27)

GANG AND POWER CARS
MT2—A4—A5

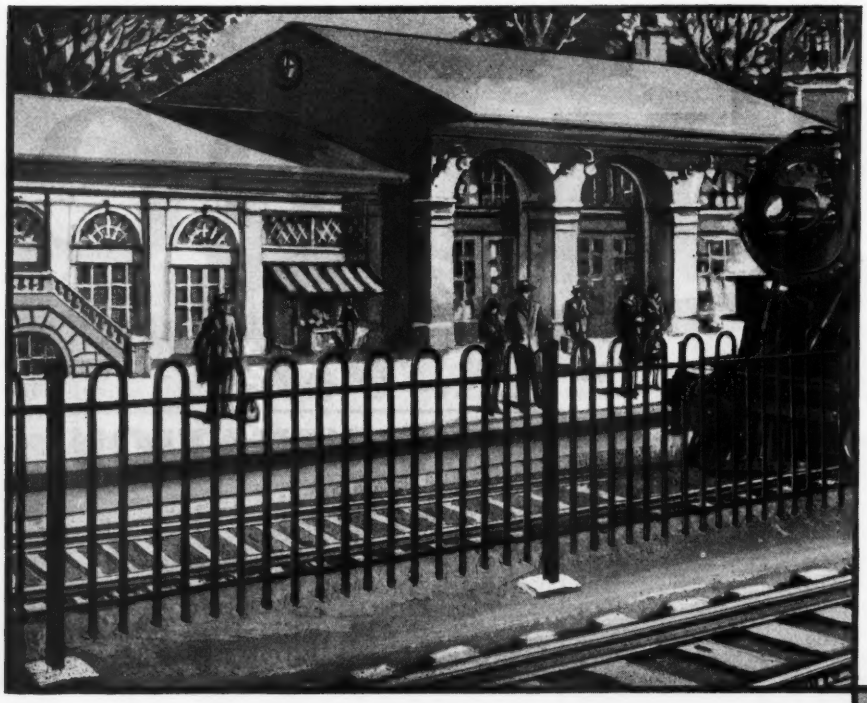
PUSH CARS AND TRAILERS
T1—T2—T3—T12—T20—T24—T25

ROLLER AXLE BEARINGS
Ringsealed-Axlsaver—Bower—Hyatt—Timken

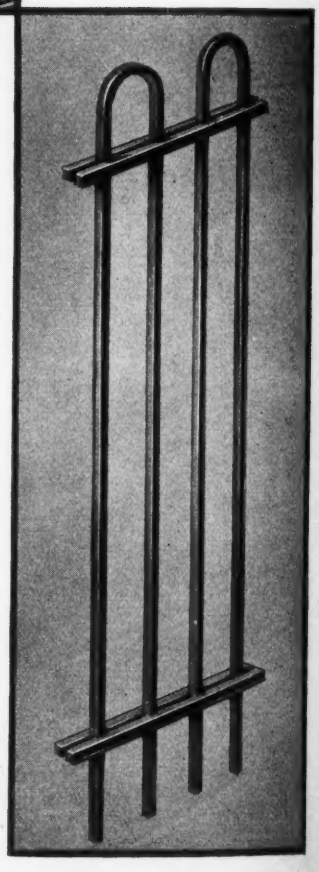
MOTOR CAR ENGINES
QB—PHB—PHA—QHB and W

WHEELS AND AXLES

W O R L D K N O W S



The Strength is in the Weld . . .



Welded strength insures long, maintenance-free life . . .

for this Anchor-Weld Intertrack Fence

THE panels cannot buckle or sag; the pickets cannot loosen. Permanent alinement and rigidity is guaranteed by the Anchor-Weld method of manufacturing iron intertrack fence.

Pickets and rails become a solid panel—each picket inseparably welded to the rails at 32 points. Not only does this welded construction provide exceptional strength, but it also results in a fence of attractive appearance, since unsightly braces and other reenforcements are not required.

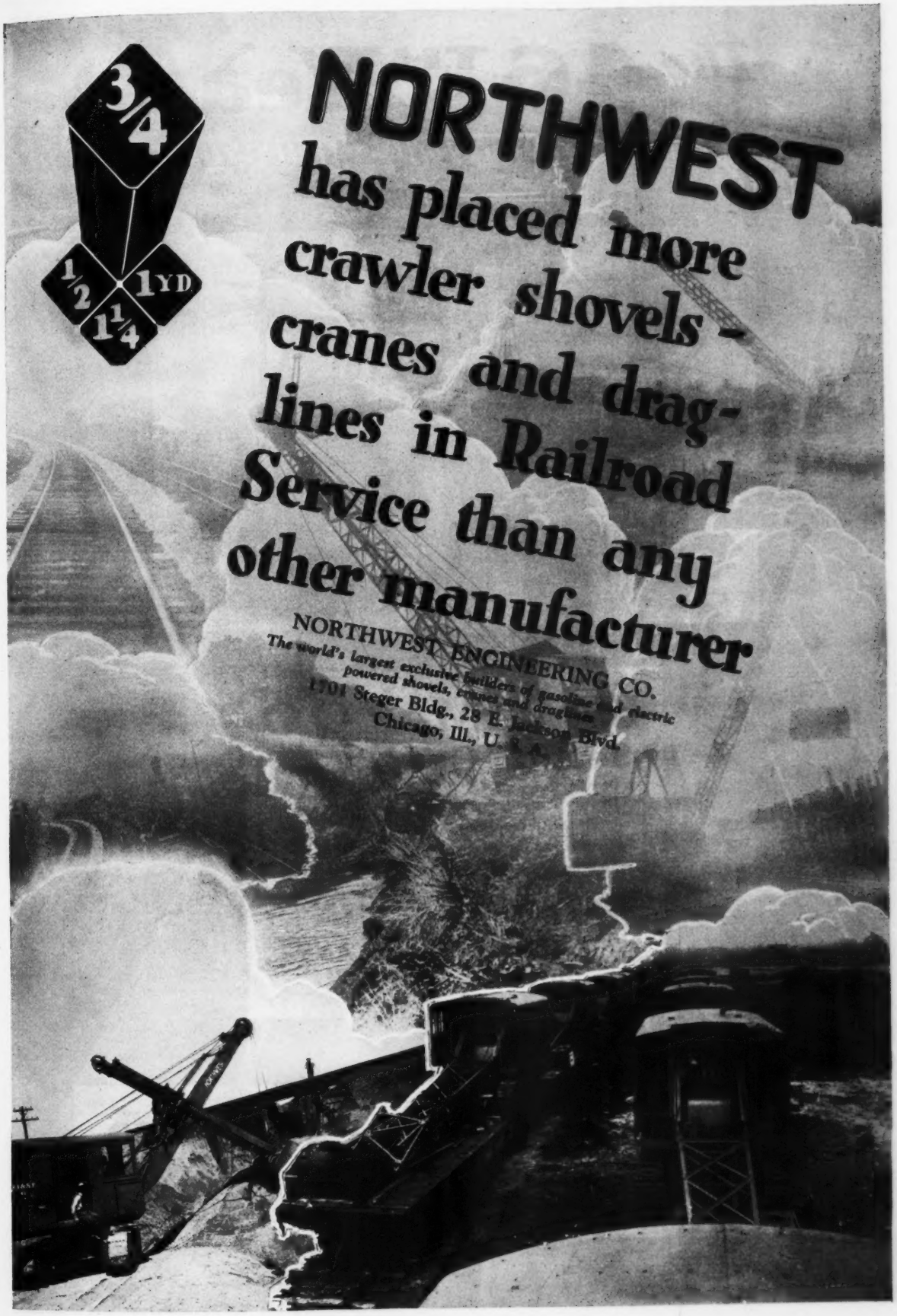
A 'phone call to the nearest Anchor office will bring a detailed description of Anchor-Weld Intertrack Fence.

ANCHOR POST FENCE COMPANY
Eastern Avenue and Kane Street, Baltimore, Md.

Albany; Boston; Charlotte; Chicago; Cincinnati; Cleveland; Detroit; Hartford; Houston; Los Angeles; Mineola, L. I.; Newark; New York; Philadelphia; Pittsburgh; St. Louis; San Francisco; Shreveport

Representatives in all principal cities. Consult local classified directory.

ANCHOR Fences


3/4
1/2
1YD
1 1/4
NORTHWEST
has placed more crawler shovels - cranes and drag-lines in Railroad Service than any other manufacturer
NORTHWEST ENGINEERING CO.
The world's largest exclusive builders of gasoline and electric powered shovels, cranes and draglines
1704 Steger Bldg., 28 E. Jackson Blvd.
Chicago, Ill., U. S. A.

The 46TH Year
of constantly improving service to Railroads

KALAMAZOO
Section Car No. 22

This new model combines unusually light weight with unusual strength and power. With the engine balanced over the front axle, it is an easy task for one man to handle the car alone. Safe, silent, compact, economical. Operates like an automobile.

"KALAMAZOO MEANS SERVICE TO YOU"

KALAMAZOO RAILWAY SUPPLY CO.

Established 1883

KALAMAZOO MICHIGAN

Service that *Satisfies*

The formula for satisfying Spike and Bolt service is simple enough— . . . . .

To a thorough knowledge of track maintenance add an organization of experts in the production of steel products.

Combine with this adequate equipment carefully maintained, and painstaking inspection.

The result is a service that fulfills all requirements—the kind of service you expect to receive from the Illinois Steel Company.

Illinois Steel Company

SUBSIDIARY OF UNITED STATES STEEL CORPORATION

General Offices: 208 South La Salle Street, Chicago, Illinois

KREOLITE

LIFE OF TREATED TIMBER DEPENDS UPON CHARACTER OF PRESERVATIVE USED

In order to insure the purchaser of a pure and uniform product, *we distill all of our own creosote oil.*

By our own method of distillation, it is possible to insure to the purchaser a uniform, pure Creosote Oil of any grade desired.

We have treated hundreds of millions of feet of timber in the past seventeen years without a single instance of decay.

Enormous stocks of Railroad Cross Ties, Switch Ties, Structural Timbers and Piling, in all sizes, in Solid Oak or Pine, properly sticked, stacked, and air seasoned before treatment, available for prompt shipment from Toledo, Ohio, or our Midland Creosoting Company plant at Granite City, Ill. (East St. Louis).

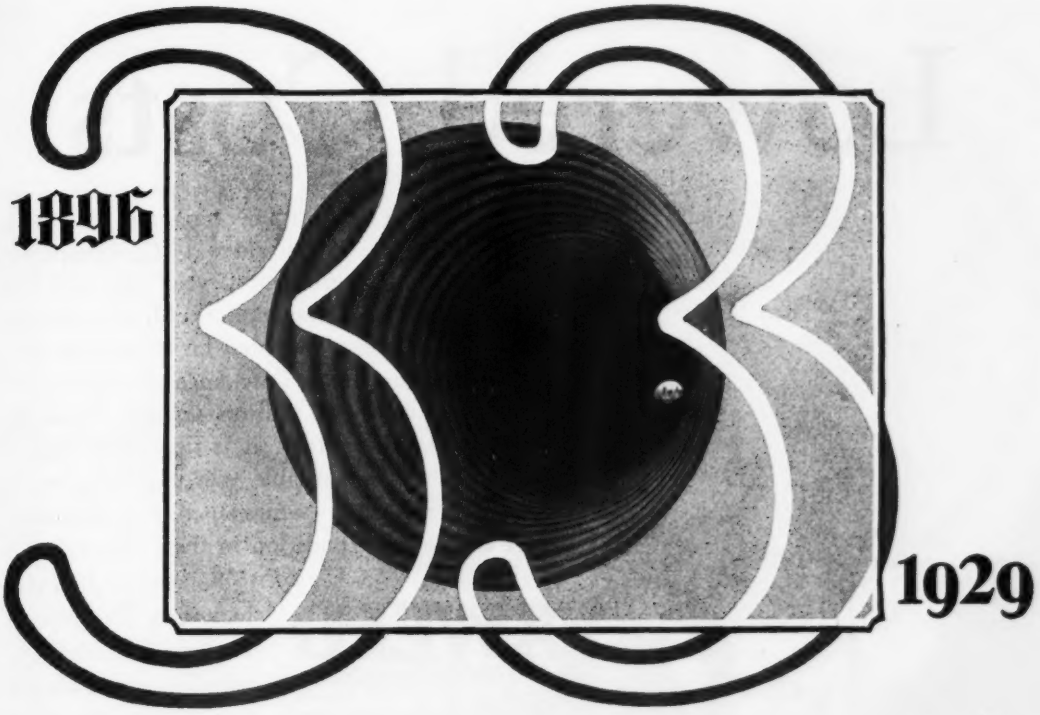
We specialize in framing timbers to your plan before treatment.

Quick shipment on short notice.

THE JENNISON-WRIGHT COMPANY, TOLEDO, OHIO

Branches in All Large Cities

R.R. TIES



33 years prove flexibility

twenty-three years prove pure iron

Armco Culverts endure in drainage service

IN 1896 the first corrugated culverts were put in service. Flexibility gave these black iron pipes their strength, pure iron gave them their durability. Today, after 33 years' use, 85 per cent of them are still in service.

In 1906 Armco Ingot Iron (the purest iron made) was first produced — to improve the uniformity of these first veterans. Today, 23 years of actual service testify to the durability of Armco Ingot Iron in drainage service. There has been no change in the analysis — no change in design since the first Armco Culvert was produced in 1906—*that* is significant to the buyer who wishes preproved durability in drainage structures.

"Look under your roads"

The durability in drainage service of Armco Ingot Iron is clearly written under America's railways. You can read this message in every state and province. Armco engineers will gladly assist you in making an actual investigation in your territory.

Armco culverts and drains are manufactured from the Armco Ingot Iron of The American Rolling Mill Company and always bear its brand

ARMCO CULVERT MANUFACTURERS ASSOCIATION
MIDDLETOWN, OHIO

ARMCO CULVERTS

©, 1929, A. C. M. A.

"Look under your roads"

Lowered Costs

RAILWAY operating expenses for 1928 were the lowest since 1922. Compared with the preceeding year they fell 3.2 per cent., or 149 million dollars. Of this amount maintenance items accounted for 87 million dollars. Reductions in maintenance of equipment costs alone were 56 million dollars. Viewing these enormous savings, it is significant that at the end of this remarkable year, railway properties, with regard to maintenance, it is reported, were in the best condition in their history.

OXWELD RAILROAD SERVICE

For more than sixteen years The Oxweld Railroad Service Company, by supplying the oxwelding needs of a majority of the important railroads of the country, has been an important factor in the reduction of costs, and the improvement of railroad operating efficiency.

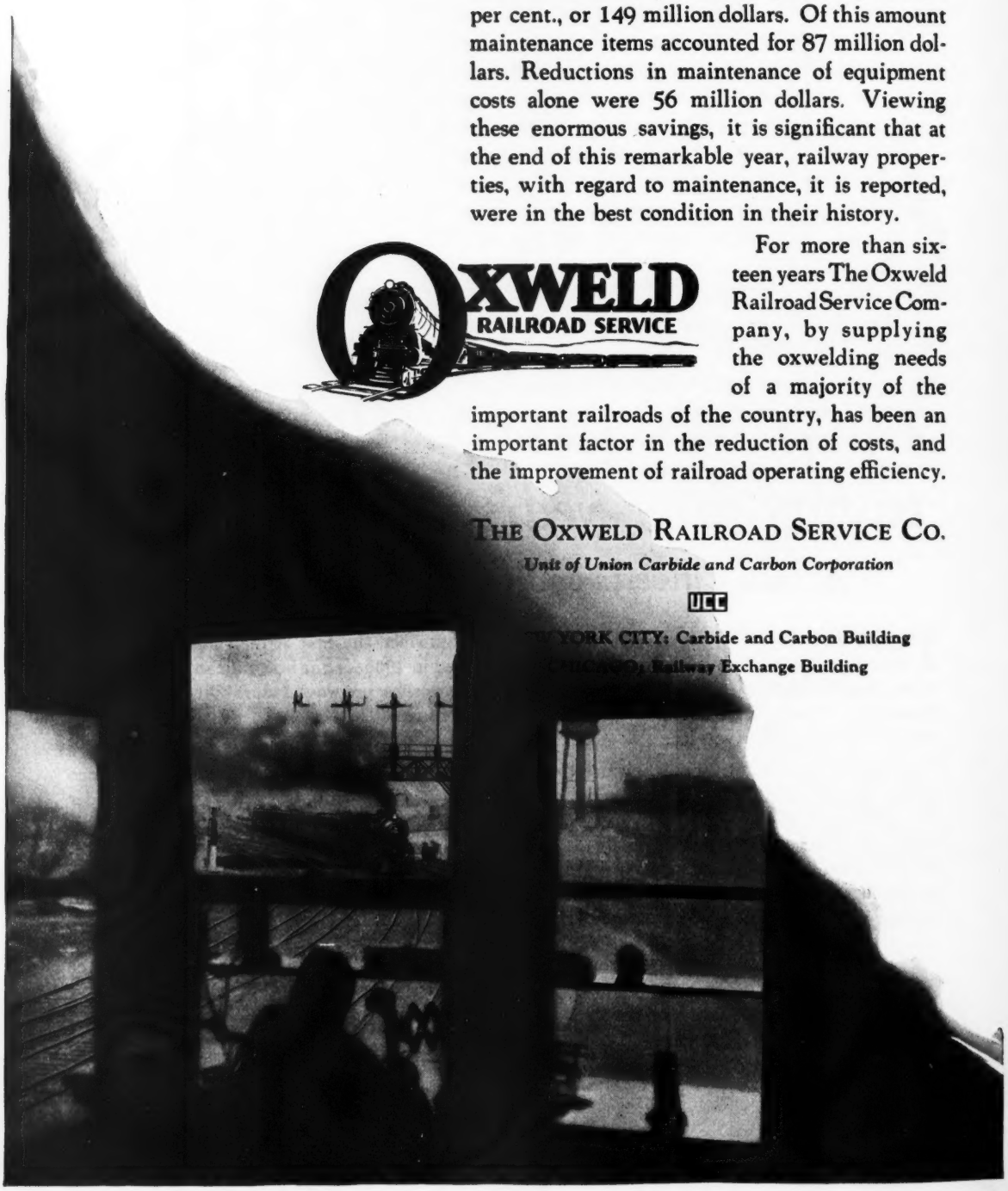
THE OXWELD RAILROAD SERVICE CO.

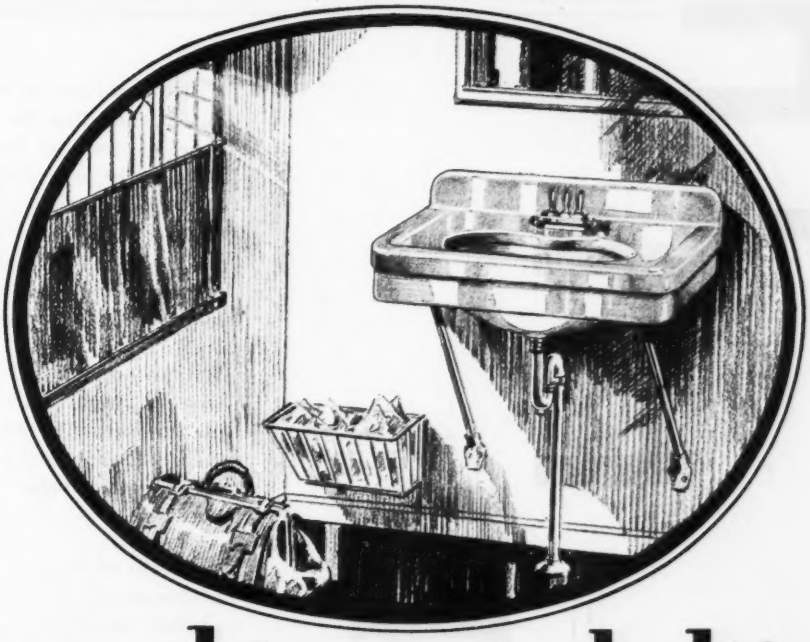
Unit of Union Carbide and Carbon Corporation

UCC

NEW YORK CITY: Carbide and Carbon Building

CHICAGO: Railway Exchange Building





Everything needed in *Railway Plumbing Equipment*

The mammoth facilities of "Standard" factories assure an adequate and dependable source of supply. In a little more than a quarter century public acceptance for "Standard" Plumbing Fixtures has required the production of *more than 35 million individual units.*

To be able to purchase your entire car plumbing fixture equipment at one source not only simplifies the purchasing but concentrates the responsibility. "Standard" offers the complete line which makes this possible.

Genuine Vitreous China Lavatories; Vitreous China Dental Lavatories; modern, extended-lip type flush hoppers, with Vitreous China bowls; and all necessary fittings—the "Standard" catalogue illustrates all of these plumbing fixtures for railroad car equipment.

Inquiry for this catalogue is invited.

Designed in strict accord with railway car requirements, "Standard" Plumbing Fixtures possess the character which has made them preferred for our better homes.

Standard Sanitary Mfg. Co.
Railroad Fixture Department
PITTSBURGH

"Standard" PLUMBING FIXTURES

THE LARGEST MANUFACTURER OF PLUMBING FIXTURES IN THE WORLD

SERVICE

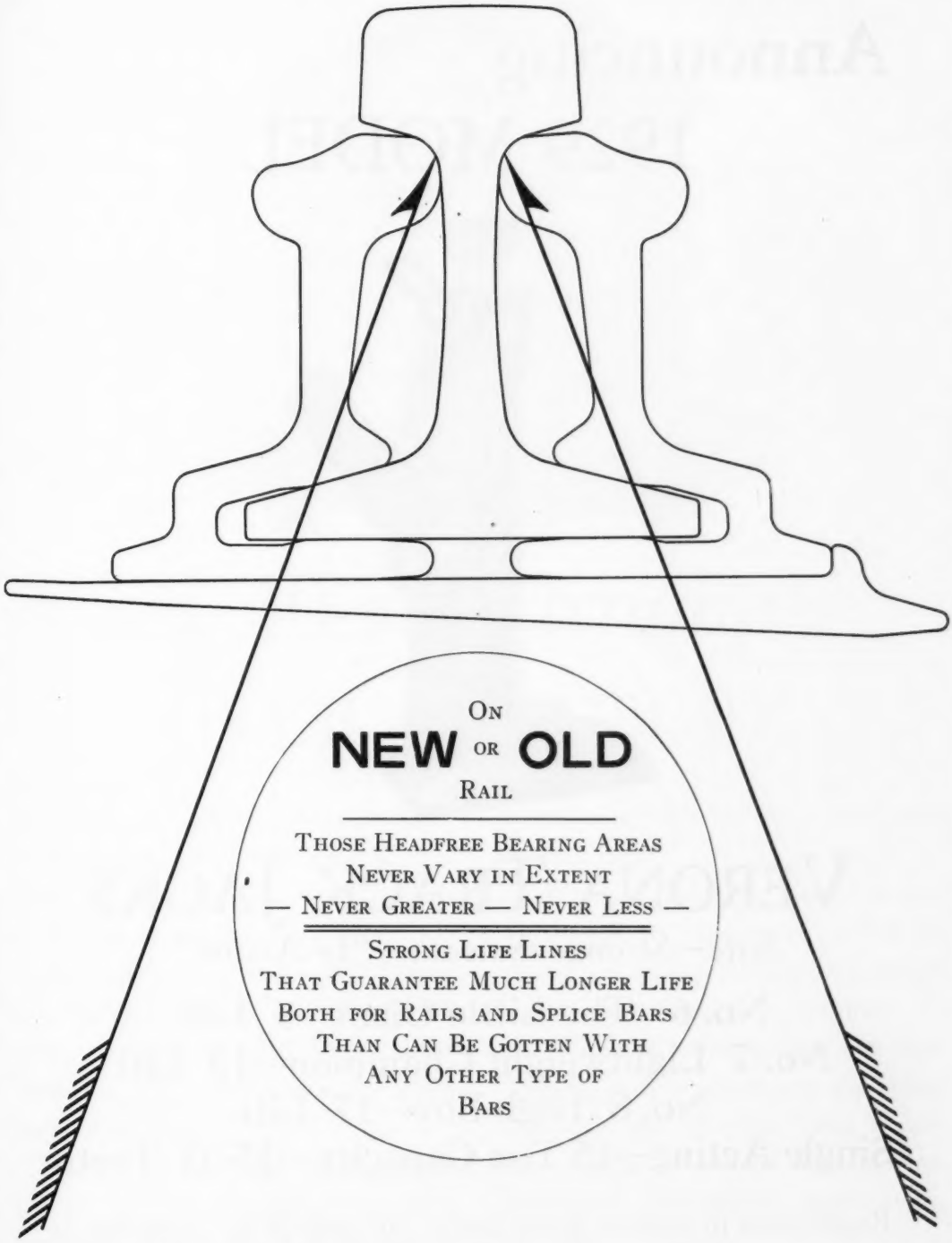
OUR success in business is based on the belief that the sale of our Rail Anti-Creepers does not complete the transaction, but goes beyond that in establishing a new obligation on us to see that these Rail Anti-Creepers give good service. We are more interested in the final results obtained from the use of our Rail Anti-Creepers than the railroads that use them.

We carry out our part of the transaction. We have an inspection organization which is at the service of the railroads, to assist them in the installation and proper use and to obtain the greatest value from our Rail Anti-Creepers.

We want all users of these devices to know of this service in the event we can be of any possible assistance.

THE P. & M. CO.

CHICAGO NEW YORK
MONTREAL LONDON PARIS
CALCUTTA SYDNEY



ON
NEW OR OLD
RAIL

THOSE HEADFREE BEARING AREAS
NEVER VARY IN EXTENT
— NEVER GREATER — NEVER LESS —

STRONG LIFE LINES
THAT GUARANTEE MUCH LONGER LIFE
BOTH FOR RAILS AND SPLICE BARS
THAN CAN BE GOTTEN WITH
ANY OTHER TYPE OF
BARS

KEEPING PACE WITH PROGRESS

THE RAIL JOINT COMPANY 165 BROADWAY, NEW YORK CITY

Announcing
1929 MODEL

VERONA TRACK JACKS

Safe—Strong—Smooth—"In Action"

No. 6 The Little Giant—5″ Lift
No. 7 Lightweight Champion—13″ Lift
No. 8 High-Boy—17″ Lift
Single Acting—15 Ton Capacity—15-32″ Teeth

Resplendent in coats of glossy green—the garb of the aristocrats of the Verona line of Extra Quality Tools.

VERONA TOOL WORKS

Pittsburgh, Pa.

A 40-year triumph
OVER MOISTURE

In 1889 the Hauser-Stander Tank Company of Cincinnati erected this Tidewater Red Cypress tank for the C. F. Thauwald Company.

After fighting the onslaughts of moisture and heat—inside and out—for 40 years, the tank is still in excellent condition and good for many more years of service.

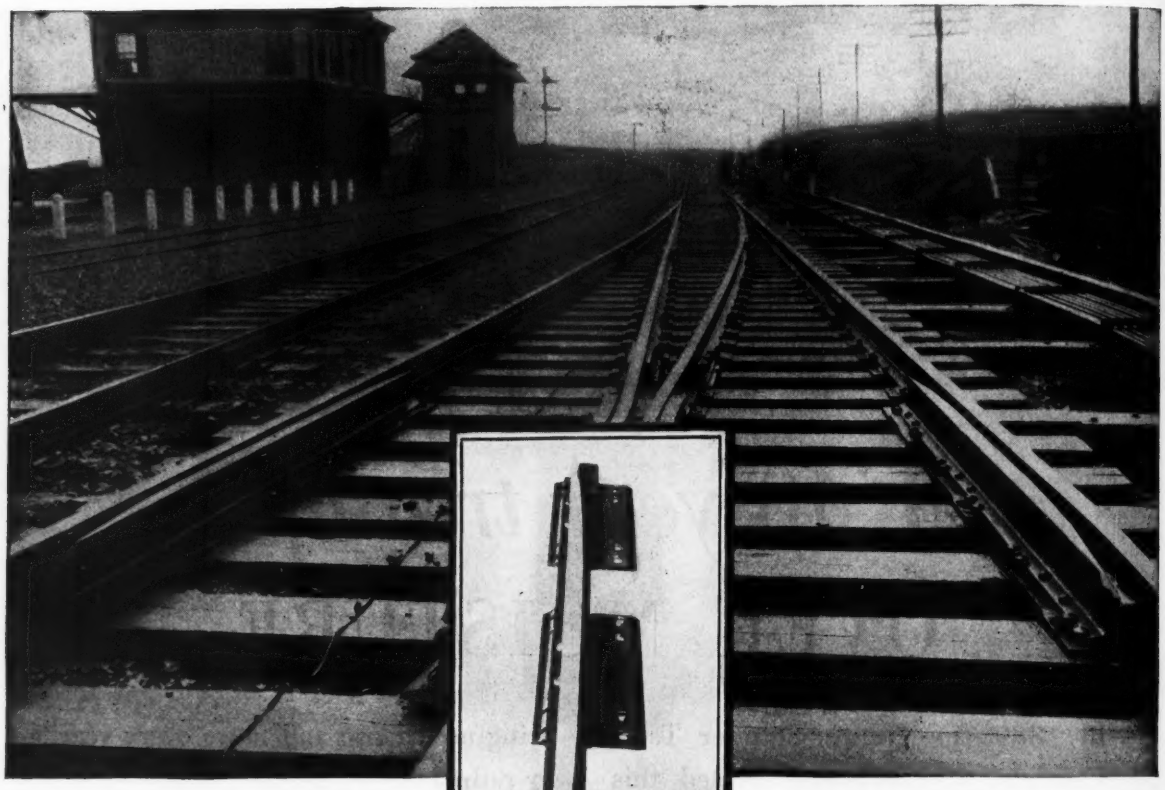
Because of its great stamina, and stability to fight moisture, even when unpainted, Tidewater Red Cypress is being used more and more every year by railroads.

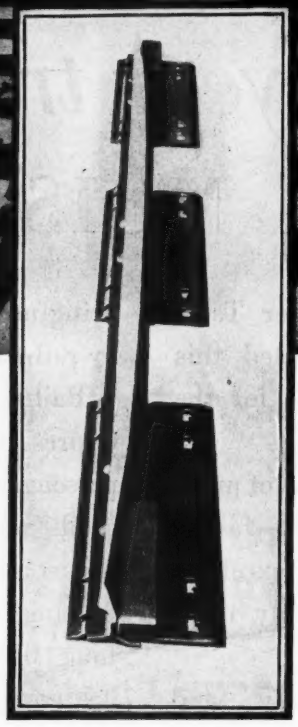
Railroads find that Tidewater Red Cypress is an economical lumber for passenger station construction, freight sheds, warehouses, ties, platforms, signal conduits, water tanks, box cars, fencing, and, in short, any use where long life and freedom from repairs are essential. Southern Cypress Manufacturers' Association, Jacksonville, Florida.

SPECIFY TIDEWATER RED CYPRESS

THE WOOD ETERNAL

High Speed *with* Safety





Bethlehem Hook Flange Guard Rail, showing base plates and foot guards.

The Bethlehem Hook Flange Guard Rail provides the utmost safety for high speed main line traffic. It has sufficient resilience to "cushion" the impact of the flange and to allow improperly mounted wheels or thick flanges to slide through smoothly and accounts for complete freedom from breakage of guard rails. This resilience makes it impossible for the flange to bite or cut the guard rail, which accounts for its unusually long life.

The Bethlehem Hook Flange Guard Rail is of one-piece construction. It is a complete unit, requiring no extra fittings of any kind. It is made of rolled steel with a depressed flange which throughout its entire length hooks under the main rail, positively preventing the guard rail from rising up or overturning. The heavy two-tie base plate is formed with a shoulder on the upper portion, against which the guard rail abuts and which prevents side movement.

The Bethlehem Hook Flange Guard Rail is therefore held positively in position against stresses from all directions, and remains permanently in place without further attention.

Write for descriptive literature.

BETHLEHEM STEEL COMPANY

GENERAL OFFICES: BETHLEHEM, PA.

Branch Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Buffalo, Cleveland, Detroit, Cincinnati, Chicago, St. Louis, San Francisco, Los Angeles, Seattle, Portland and Honolulu.

BETHLEHEM
Hook Flange Guard Rail

You Pay for Sheffields

. . . why not *get them?*

The price you pay for cheap motor cars on delivery is not their price—it is just a "down payment."

High maintenance and time lost while out of service soon bring it up to the cost of Sheffields without the advantages of genuine Sheffield service.

Sheffield policy aims at low over-all cost not the price for which it sells and no matter what cars you buy in the long run you pay for Sheffields.

FAIRBANKS-MORSE

TIMKEN BEARING EQUIPPED

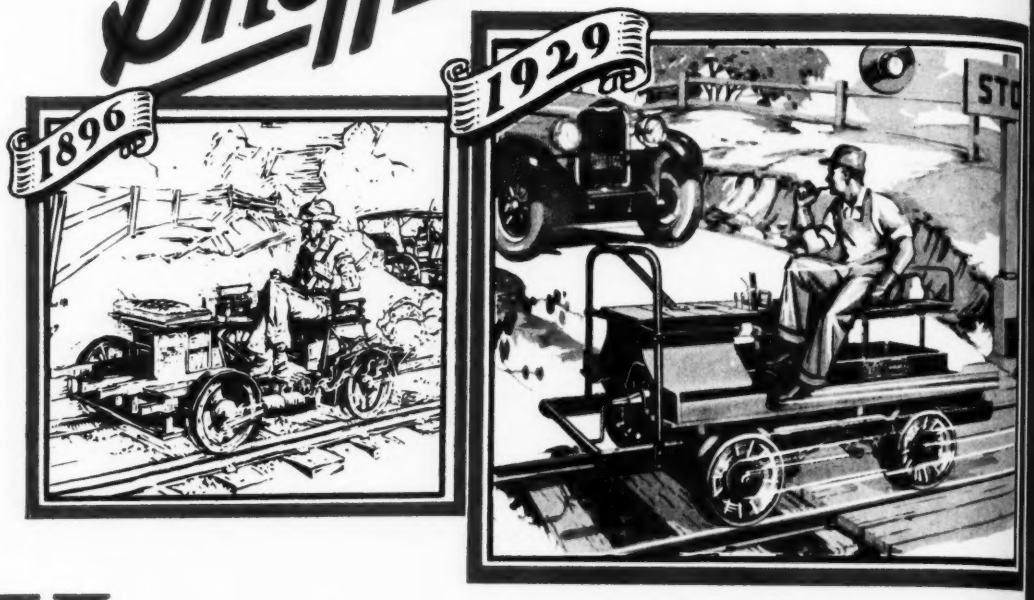
F M

MOTOR CARS

FAIRBANKS-MORSE MOTOR CARS

FAIRBANKS-MORSE MOTOR CARS

"Sheffield"



Keeping pace with Railroading

In 1896 Sheffield produced the first gasoline motor car—the first important aid to railroads in transportation of personnel and tools.

As traffic increased and conditions changed other Sheffields appeared, each improved in design to meet the new problems of railroading.

Constant research with engineering vision have maintained Sheffield leadership in motor car development.

Organization, unlimited capital with America's most completely equipped railway motor car plant have enabled Sheffield to produce Sheffield advanced designs in the lowest over-all cost car on the market.

Manufacturers of railway motor cars; hand cars; push cars; velocipedes; tank fixtures; standpipes for water and oil; oil engines; steam, power and centrifugal pumps; scales; complete coaling stations

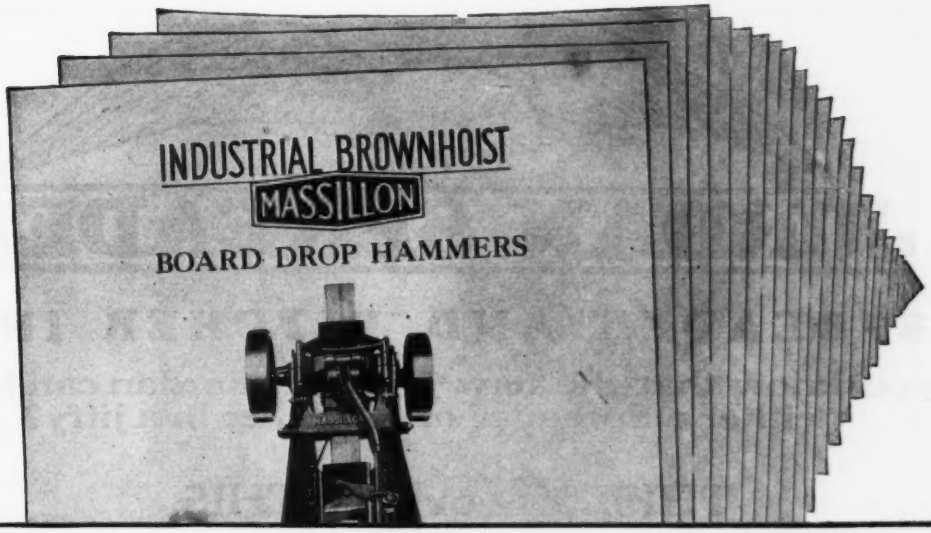
FAIRBANKS, MORSE & CO., *Chicago*

FAIRBANKS-MORSE MOTOR CARS

TIMKEN BEARING EQUIPPED

RA21.57

First on the rails ... *and still first*



Send for Copies of these New Hammer Bulletins

The reputation for quality built up by Industrial Brownhoist during the past half century stands behind the new line of Massillon Hammers now being manufactured by this corporation.

In order to better acquaint you with these hammers, we have recently published a set of bulletins which illustrate and describe the different types. Any one or a full set of these bulletins will be sent you, if you will kindly use the coupon below to designate the ones in which you are interested.

Industrial Brownhoist Corporation, General Offices, Cleveland, Ohio

District Offices: New York, Philadelphia, Pittsburgh, Detroit, Chicago, New Orleans, San Francisco.

Plants: Brownhoist Division, Cleveland; Industrial Division, Bay City, Michigan; Elyria Foundry Division, Elyria, Ohio.

INDUSTRIAL BROWNHOIST

Mail This Coupon

Gentlemen:
Kindly favor us with Bulletins of Industrial Brownhoist Massillon Hammers, as checked off below.

No. 129 Steam Drop Hammers . . . . —
No. 229 Double Frame Steam Drop Hammers —
No. 329 Single Frame Steam Drop Hammers —
No. 429 Board Drop Hammers . . . . —

Name _____
Firm _____
Address _____
City _____
State _____

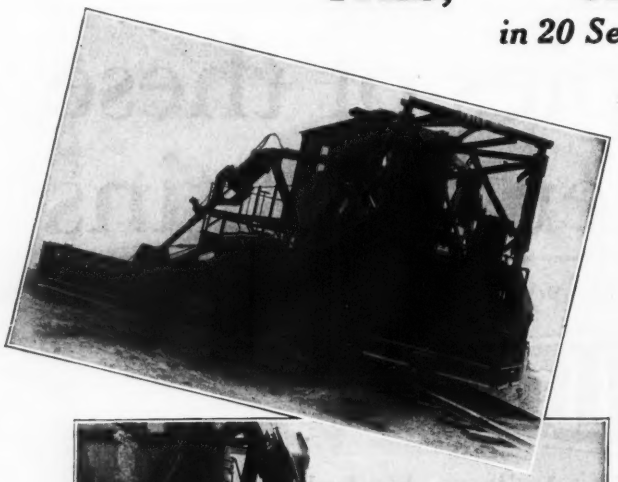
JORDAN SPREADER

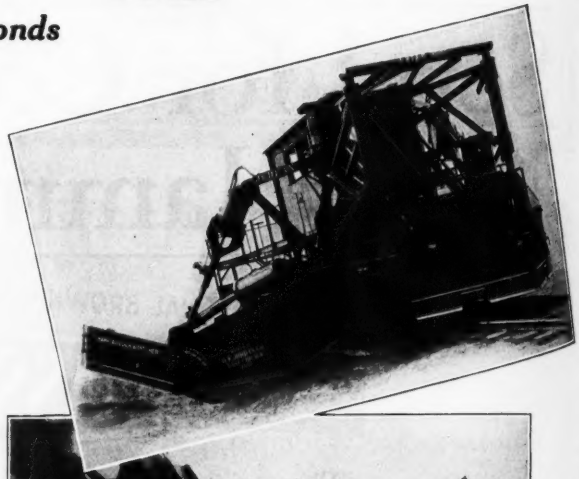
A SPREADER AND DITCHER IN ONE

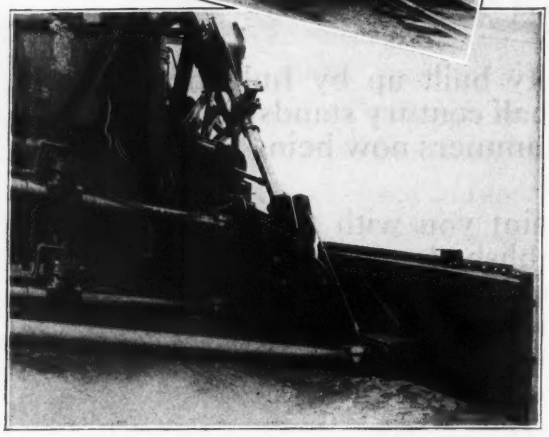
Do you know that the new type "A" Jordan can be made either a Spreader or a Ditcher in a jiffy?

THIS, or THIS

in 20 Seconds



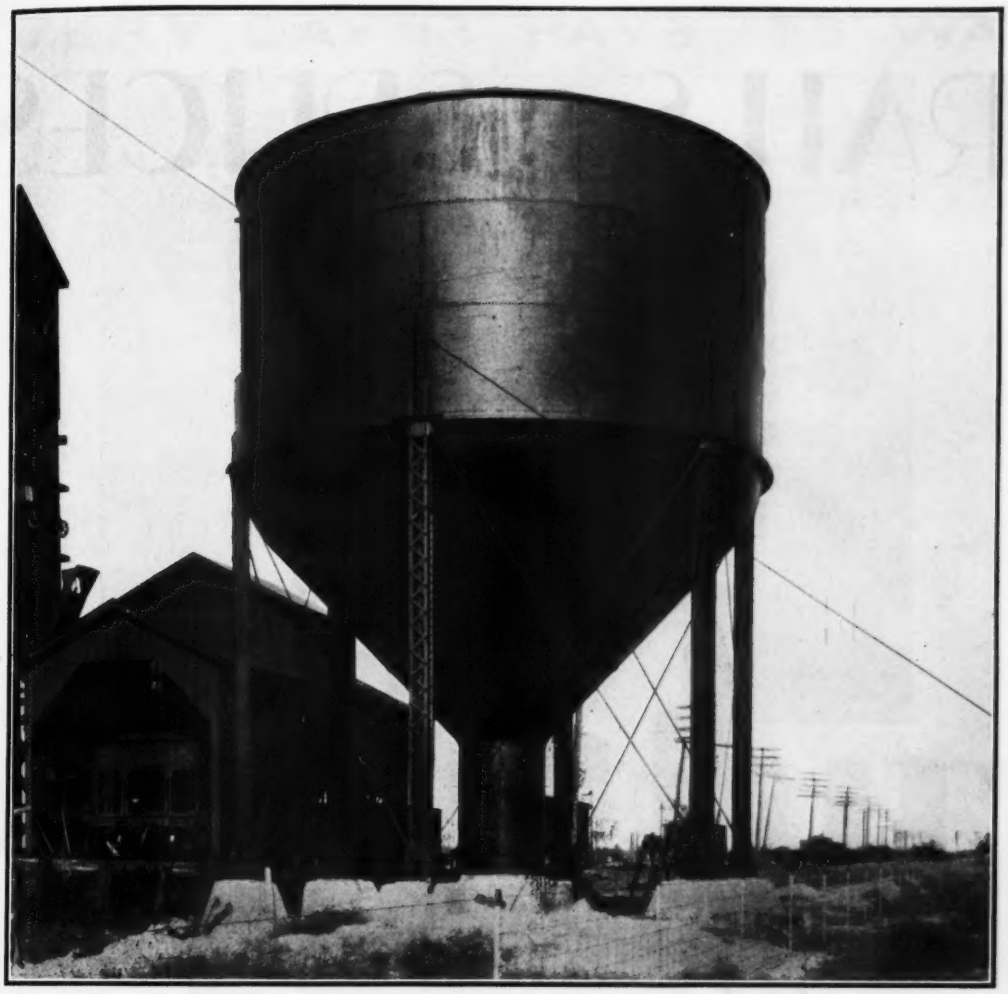




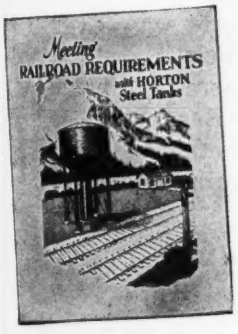
A grade can be established in a ditch bottom without disturbing the subgrade or ballast slopes by means of a mechanically operated ditch cutting section. This can be done from the operator's cab.

JORDAN SPREADER
"Does the Work of an Army of Men"
SNOW PLOW ★ ICE CUTTER ★ DITCHER
O. E. JORDAN COMPANY
WALTER A. RILEY, PRESIDENT
EAST CHICAGO, INDIANA

Wing braces are telescopic and wing can be set to any width within the maximum spread from operator's cab.



STEEL Tanks are built in large sizes



Horton elevated STEEL tanks are being built with increased capacities to meet the demand for large amounts of water at stations where traffic is heavy. The 200,000-gallon tank at a Pennsylvania Railroad water station shown above is one of our standard sizes.

Conical-bottom tanks, whether, large or small, are easy to clean. Settlings from the water collects in a small area at the bottom of the riser. From there it is washed out by the periodic opening of a quick-opening cleaning valve. A relatively small amount of water is required to clean a tank in this manner and the tank is kept in service all the while.

Ask for a copy of our booklet describing steel tanks for all types of railroad service.

CHICAGO BRIDGE & IRON WORKS

Chicago	2452 Old Colony Bldg.	Detroit	1519 Lafayette Bldg.
New York	3156 Hudson Term. Bldg.	Philadelphia	1609 Jefferson Bldg.
Cleveland	2202 Union Trust Bldg.	Atlanta	1036 Healey Bldg.
Dallas	3309 Magnolia Bldg.	San Francisco	1007 Rialto Bldg.

B-72

HORTON TANKS

RAILS & SPLICES

Into every rail and splice bar manufactured by this company the name "Carnegie" is rolled. This name on steel represents years of conscientious effort to give steel users better products—it represents control of manufacture from the mining of the ore to finished product—it represents unlimited facilities for proper manufacture—it represents the work of experienced metallurgists—the pride of skilled workmen in their craft. It represents a friendly spirit of service and cooperation. Carnegie Rails and high carbon, oil quenched Splice Bars bear this name—our guarantee of your satisfaction. Whether your order be small or large, you may expect the same prompt and efficient service.

Let us quote on your next requirements

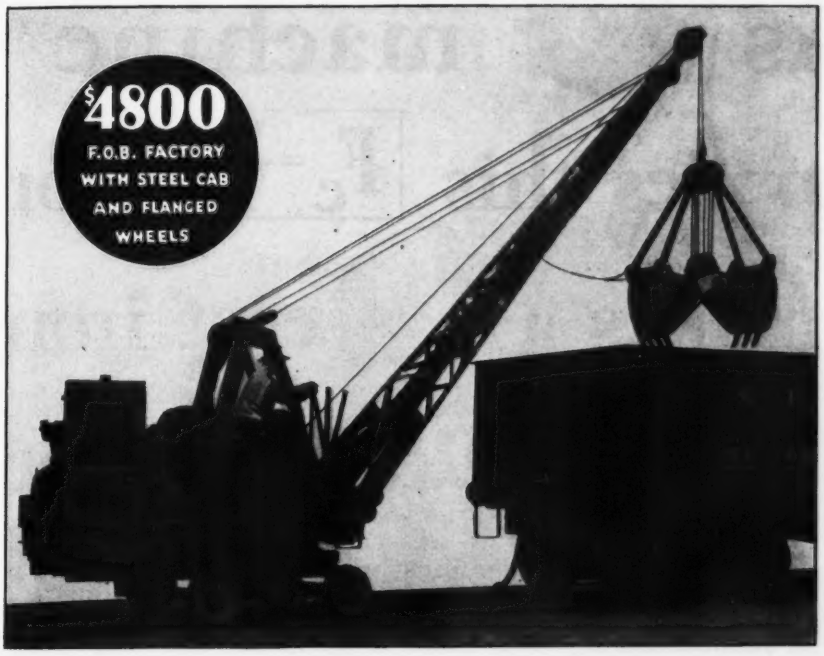
CARNEGIE STEEL COMPANY

Subsidiary of United States Steel Corporation

CARNEGIE BUILDING—PITTSBURGH, PA.

1943

"EVERY DAY IT PAYS ITS WAY"



DEPENDABILITY

Quickly convertible to Clamshell, Dragline, Orange-peel or Crane, the sturdy, compact Buckeye Utility Crane reduces non-productive hours to a minimum. Being so versatile, it renders a wide range of efficient service and well planned work finds profitable use for this Buckeye every day in the year.

It is available in two mountings. *Flanged wheels* permit operation from track or from rails laid on flat cars. *Alligator (crawler) traction* is for service independent of track.

Among the Buckeye outstanding features are: Timken roller bearings; complete one-man control; a heavy-duty, medium-speed industrial type motor; two speeds for all operations; an adjustable-length boom and a full circle scope of operation. Detailed construction specifications and interesting performance data will be sent upon request.

THE BUCKEYE TRACTION DITCHER CO.
FINDLAY, OHIO

There's a Buckeye Sales and Service Office Near You

for over thirty years
Buckeye

This machine applies this $F_c = \frac{Wv^2}{gR}$ formula and makes a cast iron pipe which is 25% stronger

"If you cast molten iron under pressure," said engineers, "the result will be a dense tough metal of great tensile strength." The theory was correct, but high manufacturing costs made its practice seem improbable in the production of cast iron pipe . . . This was before the world had heard of deLavaud cast iron pipe.

In the deLavaud process, the molten metal is fed into a revolving cylindrical mold. Centrifugal force holds the metal against the sides of the mold and drives impurities out *with a force 40 times greater than gravity.* Slag and gas bubbles are driven out of the metal at the center.

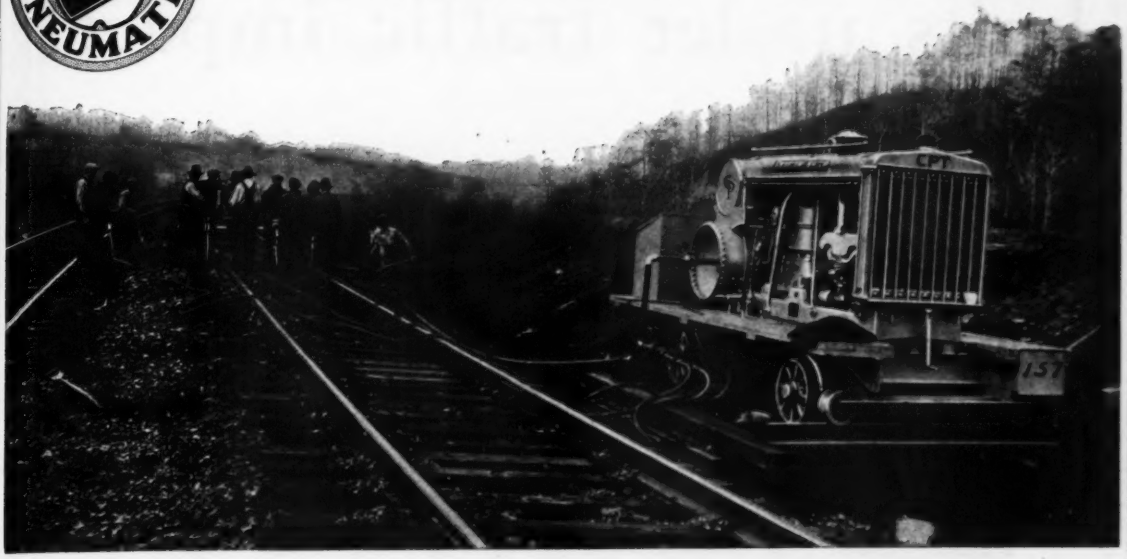
Exhaustive laboratory and factory tests have proved that deLavaud Pipe has a tensile strength of 30,000 lbs. per square inch. Because of its dense, close-grained structure, its freedom from impurities, and high tensile strength, deLavaud is 25% stronger than any other cast iron pipe. This strength permits a thinner pipe for the same outside diameter resulting in greater carrying capacity.

Write for handbook of de Lavaud Pipe which gives a fund of useful information including dimension tables and types of joints.

de Lavaud Pipe
made by
United States Cast Iron Pipe and Foundry Co., Burlington, New Jersey

Sales Offices: Chicago, Philadelphia, Buffalo, Cleveland, New York, San Francisco, Los Angeles, Seattle, Birmingham, Dallas, Kansas City, Pittsburgh, Minneapolis

SELF-PROPELLED COMPRESSOR and "STRAIGHT BACK" TIE TAMPERS



On The Job

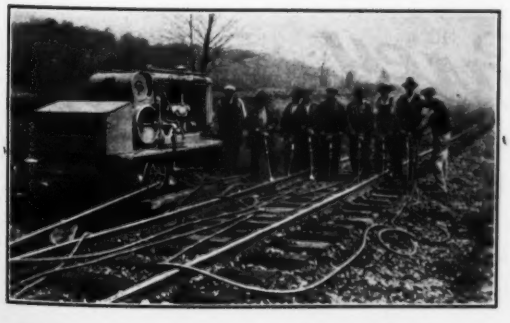
MANY railroads are using these units because of their convenience, speed and reliability. The standard CP Compressor is mounted on a truck frame carrying flanged wheels with Timken roller bearings, transverse shifting wheels and winch, air-operated lifting jacks, lifting bale and a roomy tool box. The gasoline engine that operates the compressor also propels the car at a speed of 12 to 18 miles per hour, depending upon its size. The compressor is furnished in sizes of 110, 160, 220, 265 and 310 cu. ft. per minute displacement. The CP Tampers have several interesting features that are fully described in folder No. 1646. Details of the Self-Propelled Compressors are given in Bulletin No. 789.

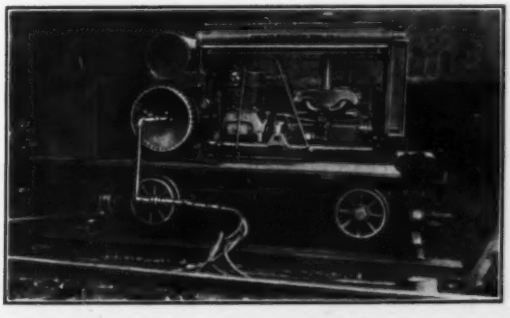
Chicago Pneumatic Tool Company

Railroad Department

6 East 44th Street, New York
1004 Mutual Bldg., Richmond, Va.
175 First Street, San Francisco
310 S. Michigan Ave., Chicago

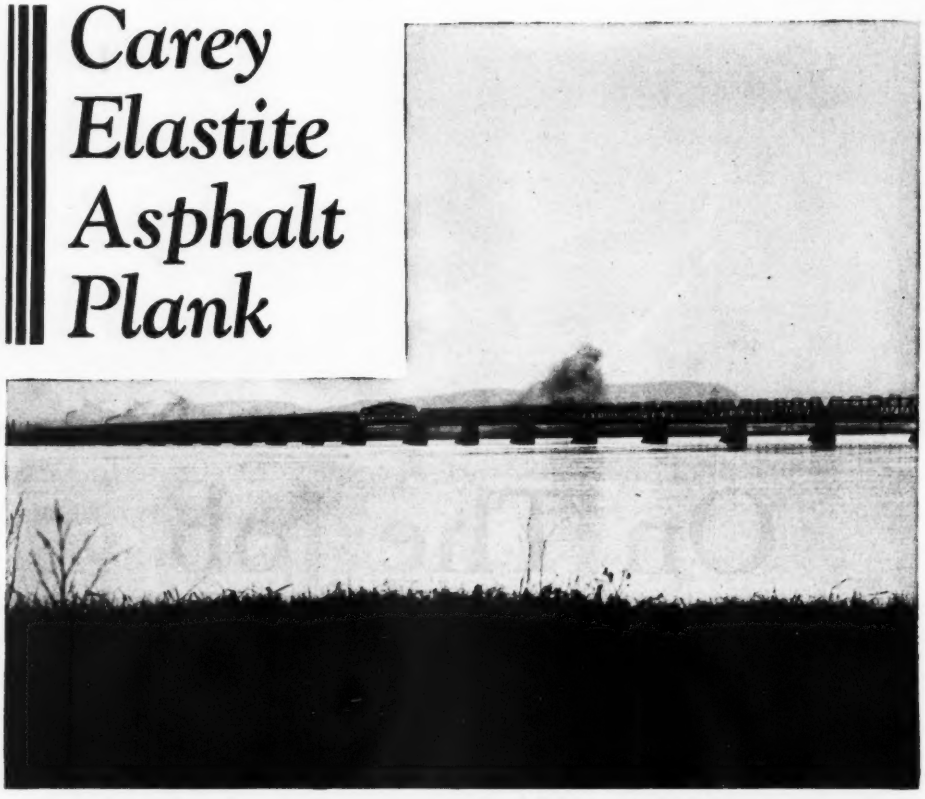
J-293





It actually knits under traffic impact!

Carey Elastite Asphalt Plank



The 25-span Victoria Jubilee Bridge of the Canadian National Railways—16 feet wide, 6,450 feet long. Its surface is protected by approximately 100,000 square feet of Carey Elastite Asphalt Plank—1½-inch thickness, applied over a laminated wood deck.

A TREMENDOUS amount of traffic shuttles over the Victoria Jubilee Bridge, owned and operated by the Canadian National Railways, which crosses the St. Lawrence at Montreal. Often as many as 12,000 vehicles, in a single day.

Yet the flooring shows little sign of wear. In fact, it seems to improve—actually improve—with service. For it is surfaced with approximately one hundred thousand square feet of *remarkable planking which knits and heals under traffic.*

Carey Elastite Asphalt Plank! It is weather-proof, easy to handle, easy to apply over any sub-structure. Because it has no grain, it cannot warp or crack. And there is practically no maintenance to it. Shall we tell you more about this unique planking — about some of the bridges it protects?

Carey Elastite
REG. U.S. PAT. OFF.
TRADE MARK REG'D U.S. PATENT OFFICE
ASPHALT PLANK

"Knits and heals under traffic"

THE PHILIP CAREY COMPANY — *Lockland,* CINCINNATI, OHIO

Corrugated Metal For Flexible Strength
Toncan Iron For Permanence

THE LINE OF TONCAN COPPER Mo-lyb-den-um IRON

HUNDRED car trains; 130 lb. rail; freights at passenger speed—here are conditions that demand flexible conduits and drains.

Corrugated metal drains have the flexibility necessary to meet the increasing strain on the track structure.

Specify culverts of Toncan Iron and you have permanency as well as structural superiority.

Corrosion was once the corrugated culvert's worst enemy but now that has been checked by using Toncan Iron.

To iron that has been thoroughly refined are added copper and molybdenum. These two elements alloy with the iron and impart a corrosion resistance that has never been reached before.

Thus Toncan Iron is particularly fitted for the permanence which is so necessary in culverts. Yet Toncan costs no more.

TONCAN CULVERT MANUFACTURERS' ASSOCIATION, *Massillon*, OHIO

The Canton Culvert & Silo Co., Canton, Ohio
The Berger Mfg. Co. of Mass., Boston, Mass.
The Berger Manufacturing Co., Philadelphia, Pa.
The Berger Manufacturing Co., Roanoke, Virginia
The Berger Manufacturing Co., Jacksonville, Florida
The Berger Manufacturing Co., Dallas, Texas
The Berger Manufacturing Co., Minneapolis, Minn.
The Berger Mfg. Co. (Export) Canton, Ohio.
Tri-State Culvert Mfg. Co. Memphis, Tenn.
Tri-State Culvert Mfg. Co. Atlanta, Ga.
The Firman L. Carswell Mfg. Co., Kansas City, Kan.
Wheat Culvert Co., Inc., Newport, Ky.
Beall Pipe & Tank Corp. Portland, Ore.
Superior Culvert & Flume Mfg. Co., Los Angeles, Cal.
Superior Culvert & Flume Mfg. Co., Oakland, Cal.
The Thompson Mfg. Co. Denver, Col.
The Pedlar People Limited, Oshawa, Ontario, Canada.

TONCAN COPPER MO-LYB-DEN-UM IRON

Think of what it means in Saving Time Saving Work and in Stronger Fences

The NATIONAL Dirt Set *Expanding Anchor* End & Corner Posts

SOMETHING entirely new in end and corner post construction—the National "Dirt Set" Expanding Anchor Angle Steel Posts. With their use—no cement is needed—no water to haul—no waiting for concrete to "set." You can set these end and corner posts and go right ahead with stretching the fence.

Simple—Time Saving—Economical. The Expanding Anchor is an exclusive feature and is one of the greatest improvements offered in years of fence construction. Catalog sent on request.

End Post

Corner Post

ALSO

Woven Wire Right-of-Way Fences—Steel Line Posts—Wire Nails—Spikes—Steel Gates—Electrical Wires and Cables—Wire Rope — Rail Bonds — Springs.

AMERICAN STEEL & WIRE COMPANY

Subsidiary of United States Steel Corporation

208 S. La Salle Street, Chicago — 30 Church Street, New York

Other Sales Offices: Boston Cleveland Worcester Philadelphia Pittsburgh Buffalo Detroit Cincinnati Baltimore Wilkes-Barre St. Louis Kansas City Minneapolis-St. Paul Oklahoma City Birmingham Atlanta Memphis Dallas Denver Salt Lake City

U. S. Steel Products Company: San Francisco Los Angeles Portland Seattle Export Distributors: United States Steel Products Co., 30 Church St., New York, N. Y.

Smoother, safer, and more lasting track with I-R Pneumatic Tampers

"The work is more thorough and uniform," says a prominent maintenance engineer.

"It is commonly agreed that the work done by these power tampers is more thorough and uniform, resulting in **added savings in maintenance** through the postponement of the need for resurfacing, and in other advantages that accrue to railway operations through the maintenance of uniform surface conditions."

INGERSOLL-RAND COMPANY

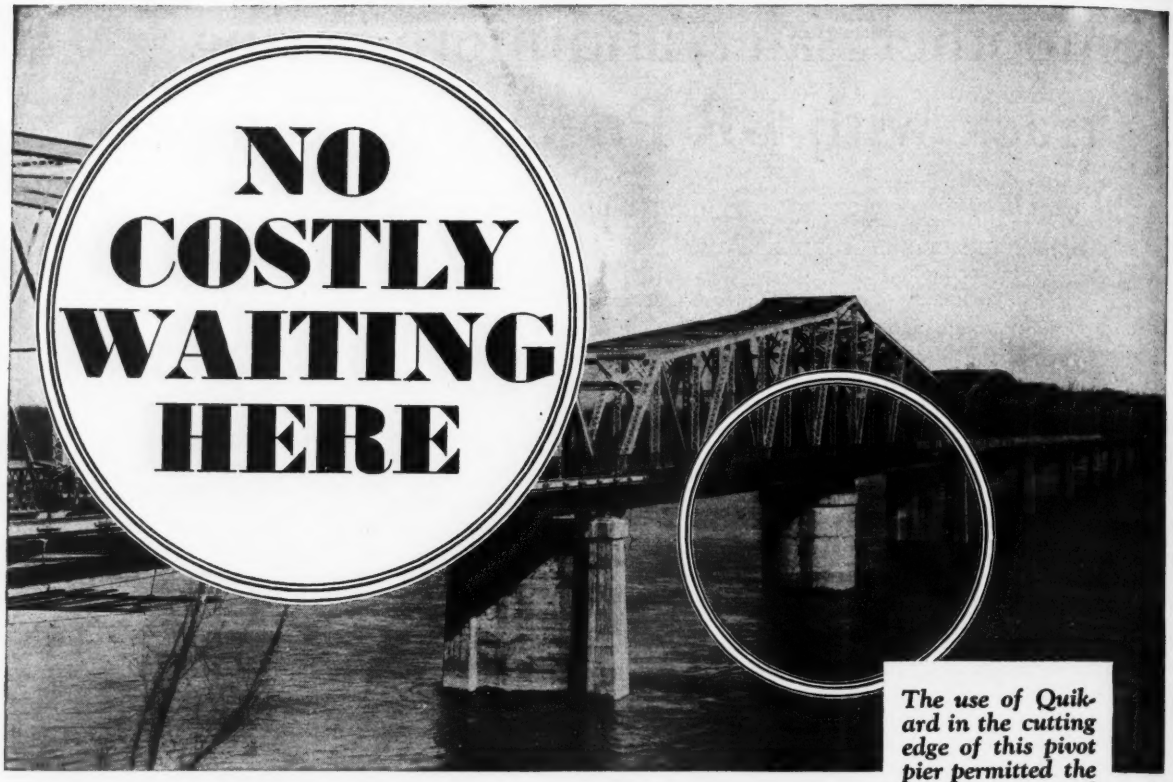
11 Broadway New York City

Ingersoll-Rand furnishes a complete line of modern air tools for track work.

Tie Tamping Outfits
Spike Pullers
Spike Drivers
Rail Drills
Bonding Drills
Track Wrenches
Wood Borers

267-TT

Ingersoll-Rand



The use of Quikard in the cutting edge of this pivot pier permitted the sinking to proceed within 24 hours—averting a 2-weeks' tie-up!

QUIKARD *Saves the Day at* Most Critical Stage!

JUST when time was all-important on this huge bridge job at Dardanelle, Ark., the Lakeside Bridge and Steel Co. faced a complete 15-day shut-down—until the pivot pier's concrete cutting edge became strong enough for sinking.

But such a delay was out of the question—so Quikard was used. Within 24 hours after placing, the caisson was lowered to the river bed and the sinking proceeded without a minute lost! The Quikard concrete withstood the tremendous pressure of the pneumatic caisson.

Quikard's great time and money-saving ability is evident. It produces a dense, watertight concrete ready for full service within 24 hours. Write for further information.

Produced ONLY by
ASH GROVE LIME & PORTLAND CEMENT CO.
Founded in 1882
KANSAS CITY, MO. OMAHA, NEBR.

QUIKARD CEMENT

QUIKARD POINTS

1. Quikard is an advanced Portland Cement, fulfilling Standard Specifications in every respect.

2. Quikard possesses remarkable plasticity; it works easily, finishes quickly and flows into forms readily and without separation.

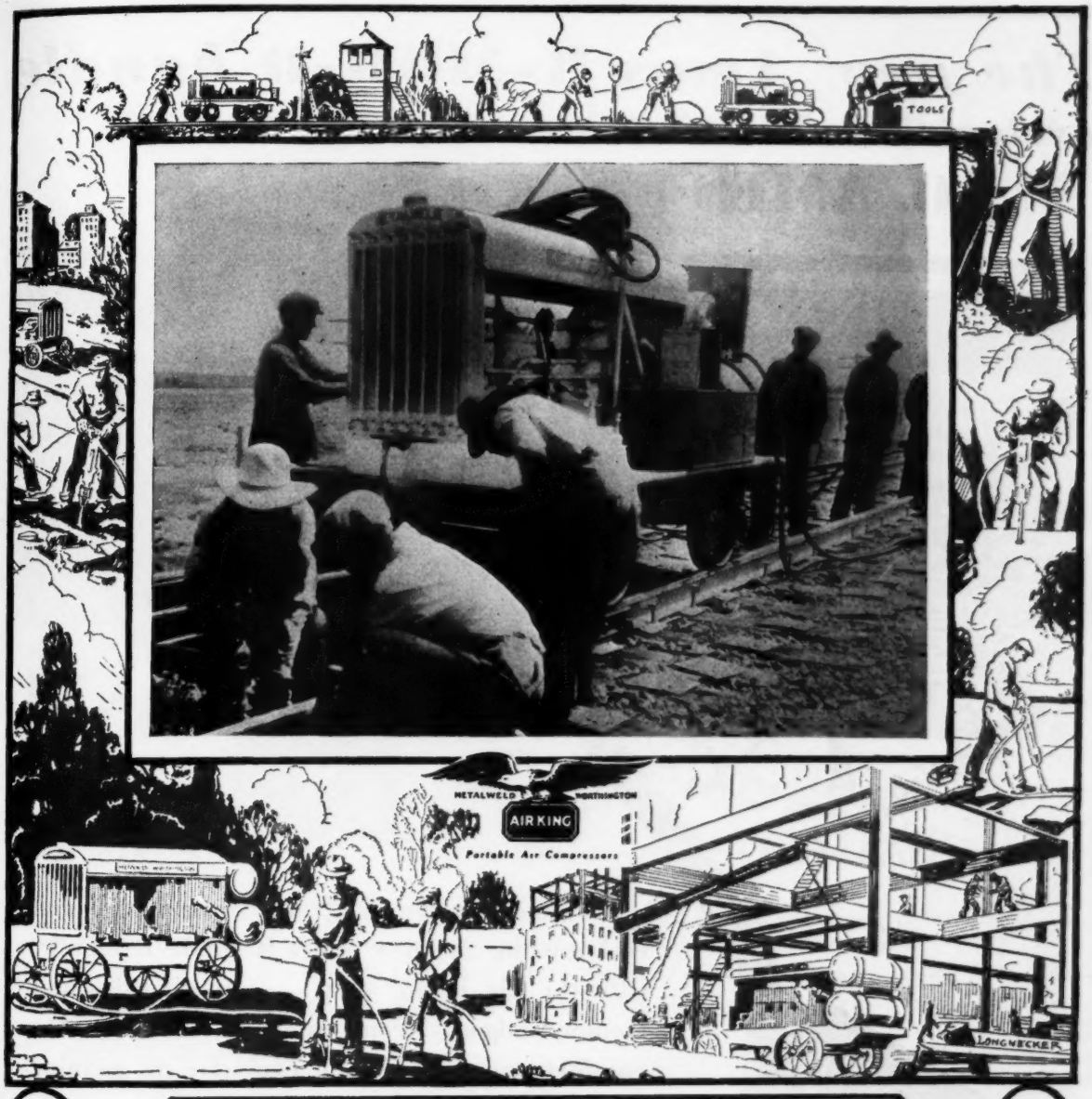
3. Quikard is designed to use 10 to 15% less mixing water than ordinary cement for necessary workability.

4. Quikard, because of its ability to retain mixing water during the hardening process, largely eliminates cracks, hair checking and accumulation of laitance during setting.

5. Quikard is proportioned like ordinary cement; its use eliminates the contraction-expansion hazard inherent in too-rich mixtures.

2912

READY-TO-USE CONCRETE IN 24 HOURS



Unquestionably the new series Metalweld-Worthington "AIR KING" Compressors represents the crowning achievement in the development of Portable Air Power. Each and every "AIR KING" is "as fine in performance as it is in appearance." Every "AIR KING" incorporates in its make up the famous "Feather Valve", the "Trigger Valve" Unloader, Force Feed Lubrication throughout, Counter Balanced Crank Shaft, and Improved Cooling System.

M-W "AIR KINGS" are built in 28, 110, 160, 210, 280 and 330 cu. ft. sizes —on mountings for all requirements —Towabout, Tractor and Rail Car models.

USE AIR KINGS FOR "PROFITABLE PORTABLE POWER"

METALWELD, INC., 26TH AND HUNTING PARK AVENUE, PHILADELPHIA

Dealers in Principal Cities

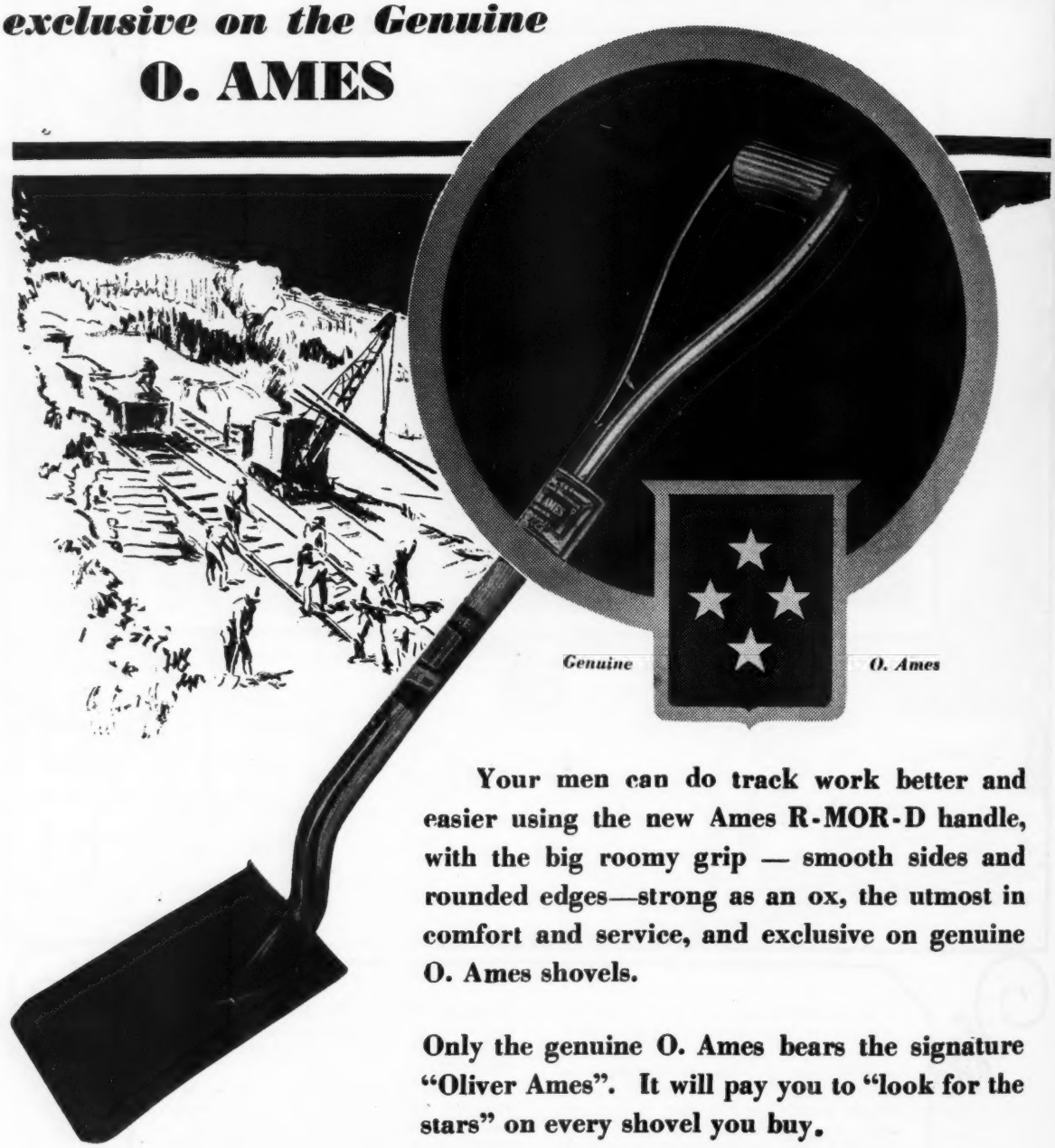
METALWELD-WORTHINGTON

PORTABLE AIR COMPRESSORS

The new Ames R-MOR-D *handle*

exclusive on the Genuine

O. AMES



Your men can do track work better and easier using the new Ames R-MOR-D handle, with the big roomy grip — smooth sides and rounded edges—strong as an ox, the utmost in comfort and service, and exclusive on genuine O. Ames shovels.

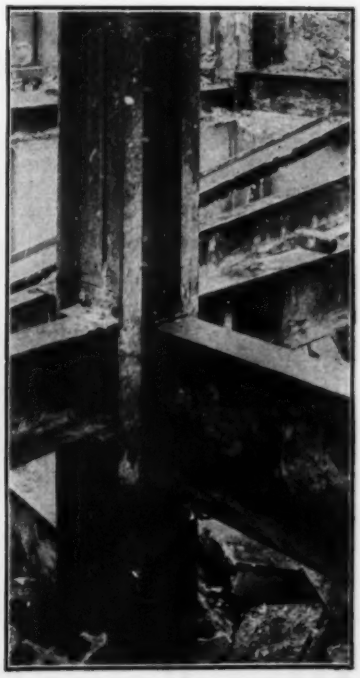
Only the genuine O. Ames bears the signature "Oliver Ames". It will pay you to "look for the stars" on every shovel you buy.

AMES SHOVEL AND TOOL COMPANY

NORTH EASTON ◂▸ MASSACHUSETTS

ST. LOUIS, MISSOURI · · · ANDERSON, INDIANA

2875



Here's Real Protection

Thirty years ago this steel was painted—and it is still in perfectly sound condition. What paint?—RED-LEAD!

AGAIN, in actual use, red-lead paint demonstrates its remarkable ability to give complete protection to metal over a period of many years.

Steel work used in the construction of the Wyatt Building, Washington, D. C., was painted with red-lead, and installed in 1897-1898. In January, 1929, this building was torn down.

Red-lead kept steel sound

The unretouched photographs reproduced on this page tell a striking story. After thirty years, the steel work is in excellent condition—still protected against rust by the original film of red-lead.

You can expect extreme durability *where red-lead paint is used.* Three coats of pure red-lead give steel work a protection that is unexcelled.

High quality red-lead

Pure, fine and highly oxidized—there is no better red-lead obtainable than Dutch Boy red-lead. It comes in two forms—paste and liquid. The liquid (ready for the brush) is supplied in six different colors. The paste comes in natural orange-red, and can be shaded to dark colors. For information on special painting problems, write to our Department of Technical Paint Service, in care of our nearest branch.

OTHER DUTCH BOY PRODUCTS

In addition to red-lead, the following products are sold under the Dutch Boy trademark: White-lead, linseed oil, flatting oil, solder, babbitt metal, lead pipe. The "Dutch Boy" guarantees high quality.

NATIONAL LEAD COMPANY

New York, 111 Broadway . Buffalo, 116 Oak Street . Chicago, 900 West 18th Street . Cincinnati, 659 Freeman Ave. . Cleveland, 820 West Superior Ave. . St. Louis, 722 Chestnut St. . San Francisco, 235 Montgomery St. Boston, National-Boston Lead Co., 800 Albany St. . Pittsburgh, National Lead & Oil Co. of Pa., 316 Fourth Avenue . Philadelphia, John T. Lewis & Bros. Co., Widener Building.

DUTCH BOY **RED-LEAD**

Woodings Tools Have Won Preference By Rendering a Superior Service

THE bigger the job the more you will appreciate the manner in which Woodings tools save time and cut costs on all classes of track maintenance and construction work.

Made from the finest steels, using the most modern methods of heat treating to provide maximum strength and toughness, Woodings Tools stand up long under hard usage.

They have proved their fitness by years of reliable service. The great number of repeat orders from test trials are very gratifying and strong evidence of the high quality, dependability and superior service rendered by Woodings Tools.

Woodings manufactures a complete line of high quality track tools, including tamping, pinch, claw and lining bars, picks, spike pullers, rail tongs, spike mauls, sledges, chisels and rail cutters—all of which meet A. R. E. A. specifications.

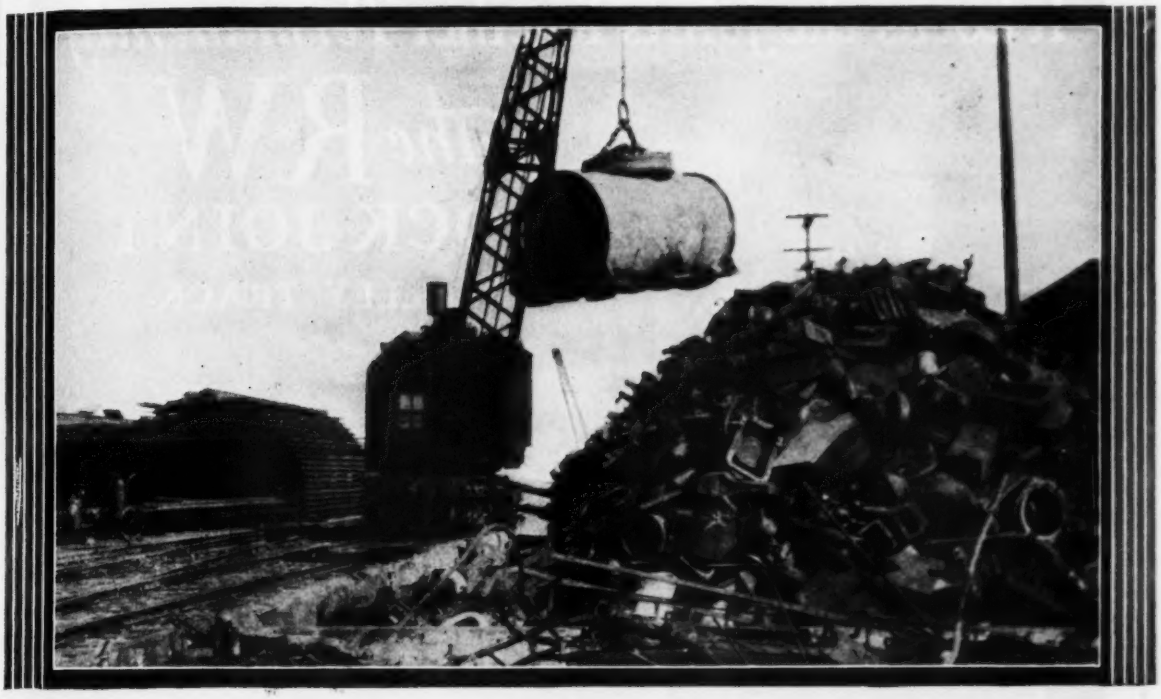
Woodings Tools are economical—they cost less when length of life and service rendered are considered.

Woodings Forge & Tool Co.

Works and General Sales Office
Verona, Pa.

WOODINGS
STANDARD TRACK TOOLS

LOWERING HANDLING COSTS



. . . . . in central storage yards

Handling costs—the bugbear of most stores departments—often mount to prohibitive figures where the handling equipment is bought on price alone. For such equipment soon invites breakdowns and costly repairs.

Realizing this, nothing is spared in the design and construction of *American* Locomotive Cranes. They offer specific advantages that provide for every point dealing with the absorption of impact, the practical distribution of strains and the transmission of power.

The effort expended on details in construction extends even to the ribs inside and also an integral part of the solid racer casting; this to doubly assure the casting against severe shocks and strains.

The weight of every *American* is evenly distributed—and the tie between the racer and the body is at the circumference of the roller path where stability is increased 50% over ordinary locomotive cranes using the king pin construction.

In addition, the famous *American* Expansive Frictions are made even more outstanding and show even greater service with the new *American* woven wire asbestos fabric facings.

These and the many other advantages offered by *American* Locomotive Cranes are fully described and illustrated in catalog form. The catalog is yours for the asking. Write for it.

AMERICAN HOIST & DERRICK COMPANY
89 South Robert Street
ST. PAUL, MINN.

Chicago	Pittsburgh	St. Louis	Indianapolis
Seattle	New York	New Orleans	San Francisco
	Birmingham	Detroit	Los Angeles

makers of the famous
AMERICAN DITCHER

AMERICAN
HOIST & DERRICK CO.

It Locks the Joints Together *Permanently*

The R-W LOCK JOINT TROLLEY TRACK

Regardless of its length, your trolley track can now be made practically a *one-piece track*, by using the R-W Lock Joint.

A perfected product of Richards-Wilcox, it locks the joints so tightly that hangers operate smoothly and trouble-free.

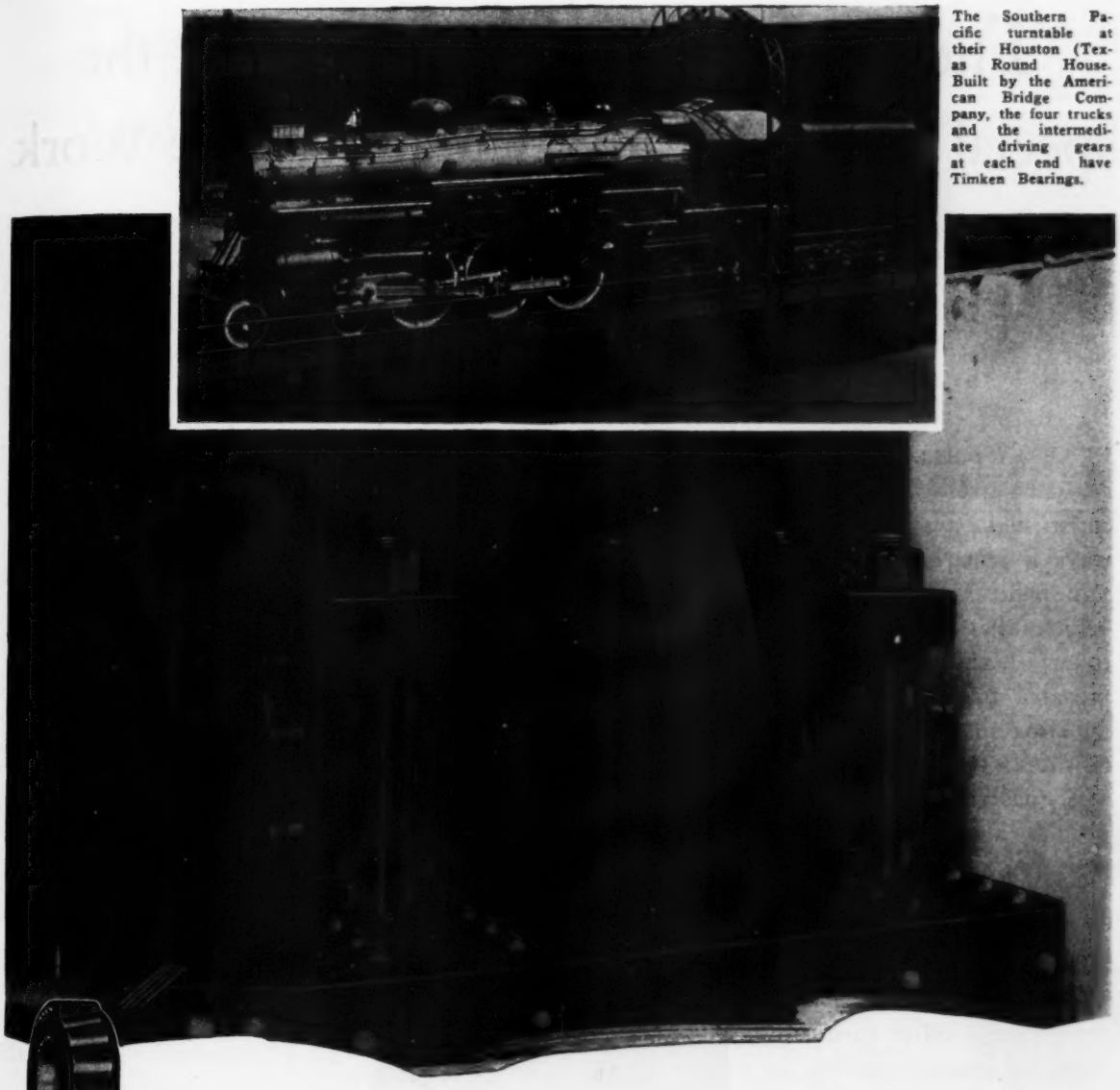
The R-W Lock Joint can be obtained only with trolley track carrying the R-W trade mark. Ask for it by name.

Richards-Wilcox Mfg. Co.

"A Hanger for any Door that Slides."

AURORA, ILLINOIS, U.S.A.

New York Chicago
Boston Philadelphia Cleveland Cincinnati Indianapolis St Louis New Orleans Des Moines
Minneapolis Kansas City Los Angeles San Francisco Omaha Seattle Detroit
Montreal RICHARDS-WILCOX CANADIAN CO. LTD. LONDON, ONT. Winnipeg



The Southern Pacific turntable at their Houston (Texas Round House. Built by the American Bridge Company, the four trucks and the intermediate driving gears at each end have Timken Bearings.

Turntables on Timkens

The loads per truck range from as much as 165,000 lbs. static load, to a maximum turning load of 125,000 lbs. Yet 12 men can turn the table under full load—two 15 h. p. motors turn it regularly. Even this motive power is remarkably low as ordinarily two 25 h. p. motors would be necessary. The saving is due to the use of Timken Bearings.

The method of truck mounting is such that the whole weight of the truck, plus its proportion of the table load, is carried on the Timken Bearings in the four-two wheeled trucks.

Gigantic loading problems find their surest solution in the extreme load capacity of Timken Bearings. Through Timken tapered construction, Timken *POSITIVELY ALIGNED ROLLS* and Timken electric steel there is Timken rigidity—Timken radial-thrust ability—full Timken endurance under great stress demands.

Timken Bearings bring anti-friction advantages to lower the power demands, to reduce the lubrication need and to add maintenance-free, trouble-free years of service to all classes of mechanical devices.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN *Tapered Roller* **BEARINGS**

These new du Pont finishes meet the special needs of Railway Maintenance Work

The remarkable du Pont synthetic resins make available the Du-Lux line

TODAY in Du-Lux Enamels and Varnishes du Pont scientists make available to railways a remarkable chemical achievement: not only synthetic vehicles that can be cooked into varnishes far superior to those prepared from natural gums, but also resins that are complete finishes in themselves and possess qualities distinct from ordinary varnishes.

The Du-Lux line has special characteristics of importance for many finishing jobs.

Dries quickly—easy to apply

Storerooms, office furniture, metal equipment, stations, for example—these you must finish in a minimum of time. Du-Lux Enamels and Varnishes dry dust-free in fifteen minutes—tack free in four to five hours. They brush freely. They remain flexible indefinitely—are very durable under the most severe conditions on exterior and interior. They resist heat, gasoline, alkali, and do not yellow. As one railway executive put it: "The Du-Lux line is just what we have been waiting for."

A complete finishing service for the railway field

Du-Lite, a wide variety of primers, aluminum vehicles and other du Pont products, put at your command scientific finishes for every surface proved by the leading railways the country over. A.C.E. is famous as a preservative where all others have failed.

Du Pont technical men are always at your command to study your specific finishing problems. Write for further data about the Du-Lux line.

DU PONT DUCO REG. U.S. PAT. OFF.

Du-Lux Enamels and Varnishes

E. I. DU PONT DE NEMOURS & CO., Inc.

Railway Sales Department, Parlin, N. J.

Chicago, Ill. San Francisco, Cal.

Flint Paint & Varnish Limited, Toronto, Ontario, Canada

DUCO HELPS SELL RAILWAY TRANSPORTATION

The most Flexible tamping outfit on the market!

FLEXIBLE — because easily portable, and easily handled without extra equipment that takes time and labor. Flexible, too, because of its great utility in operating a large number of electrical tools—that's the SYNTRON Power Unit!

The SYNTRON Electric Tie Tamping Outfit is the most efficient track surfacing apparatus in existence. It does not need special cribbing, engines or cranes. It has a Power Unit that is light in weight, only 20 inches in width and equipped with dolly wheels for quickly moving along a rail. When in operation, it fits snugly on the track shoulder. The same men who tamp track move the Unit about.

With a SYNTRON, you can operate four, six or eight tampers, a large number of portable tools, including an arc welder, and cuts track surfacing costs lower than you ever thought was possible.

Now is the time to investigate. Literature describing the new SYNTRON outfit will be sent free on request. Write for it today.

SYNTRON COMPANY

400 Lexington Ave.

PITTSBURGH, PA.

SYNTRON

ELECTRIC TIE TAMPING OUTFITS

No. 5 of a series

PUBLISHER OF
RAILWAY AGE
RAILWAY MECHANICAL ENGINEER
RAILWAY ENGINEERING AND MAINTENANCE
RAILWAY ELECTRICAL ENGINEER
RAILWAY SIGNALING
MARINE ENGINEERING AND SHIPPING AGE
THE BOILER MAKER

Railway Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING COMPANY

"THE HOUSE OF TRANSPORTATION"

PUBLISHER OF
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BOOKS ON TRANSPORTATION SUBJECTS

NEW YORK 30 CHURCH STREET | CHICAGO 105 WEST ADAMS ST. | CLEVELAND 50 PUBLIC SQUARE | WASHINGTON 17TH AND H STS. N.W. | SAN FRANCISCO 215 MARKET STREET

ADDRESS REPLY TO
105 WEST ADAMS ST.
CHICAGO, ILL.

April 25, 1929

Dear Reader:
Everywhere

Have you ever observed the attention which a successful contractor gives to the care of his men? If you have, I am sure that you have realized that the reputation for plenty of wholesome food and a clean, comfortable place to sleep has served many a contractor in good stead in times of labor shortage. In view of the wide-spread appreciation of this fact among contractors, I long wondered at the indifference of the railways to the value of attractive camps. But within the last few years a new influence has been at work, the magnitude of which I doubt if you appreciate. At least its extent has been a surprise to me as I have investigated the practices of the larger roads of the country.

I wonder if you would have had the temerity to have suggested, even as recently as 10 or 12 years ago, that your road should provide shower baths for its floating gangs, that their cars be equipped with electric fans and that provision should be made for recreational facilities. Yet all these and more are to be found in camps on progressive roads today. The more that I have studied this subject the more I have become convinced that such added comforts, judiciously installed and properly maintained, yield large returns to the railways.

To show how far this development has gone and to bring to your attention the experience of those who have undertaken such measures, we are publishing in this issue the first of a series of four articles on modern trends in the housing of maintenance of way employees. In this article we present the results of a survey of present practices on a number of roads in the equipment of camp cars for floating gangs. In the June issue, there will be presented a more detailed description of the camp equipment of two roads which have gone far beyond general practice in the improvement of these facilities. The July issue will contain a similar survey of the trend in the provision of bunk and section houses at fixed locations, while the August issue will contain specific references to outstanding camps of this character.

Through these articles we hope to portray the development in the housing of maintenance of way labor and the results secured therefrom, and thereby aid in the development of a more contented and efficient force of employees. It is my hope that these articles may be both interesting and helpful to you in meeting this problem with your own forces.

Yours very truly,

Elmer T. Howson

Editor.

ETH*MM

MEMBERS: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.

WHY you get Greater Yardage at Lower Cost!

from

P&H ½Yd. EXCAVATOR

Model 300-A is full revolving . . . powered with a 50 h.p. motor . . . all main frames are huge unit steel castings . . . the swing speed is 5½ r.p.m. and the line speed 155 feet per minute . . . Chain Crowd . . . and power clutch control.

It is fully developed from the experience gained by P & H in building over 2600 Gasoline-Powered Excavators . . . more than any other make. Not the cheapest machine but you get from it "Greater Yardage at Lower Cost." Write for Bulletin GH-3.

HARNISCHFEGER CORPORATION

Established in 1884

3820 National Avenue, Milwaukee, Wis.

New York, Philadelphia, Birmingham, Atlanta, Chicago, Kansas City, San Francisco, Indianapolis, Charlotte, Detroit, Dallas, Pittsburgh, Baltimore, Memphis, Los Angeles, Des Moines, Minneapolis, Seattle, Cleveland, Boston, St. Louis, Jacksonville

WAREHOUSES AND SERVICE STATIONS

Philadelphia, Memphis, Jacksonville, San Francisco, Los Angeles, Seattle, Dallas

P&H

Four Miles of Retaining Wall

A recent Federal Retaining Wall erected by the Grand Trunk R. R. as part of their De Quindre grade separation project at Detroit.

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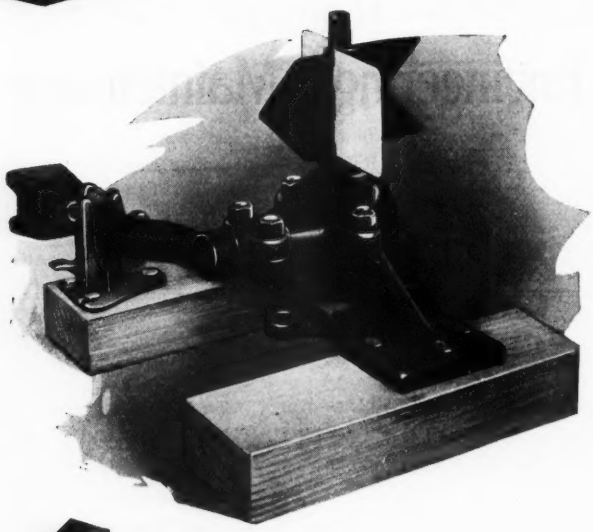

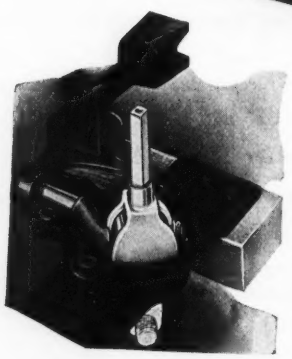

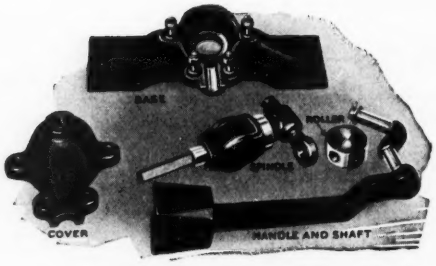

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Railway
Engineering and Maintenance

Volume 25 May, 1929 No. 5

Defects in Supervision

IN GOING over a branch line of an important railway with the roadmaster a short time ago, a system supervisory officer was surprised to overhear a foremen greet the roadmaster with the statement that he "had not seen him for six months." On another road on which an accident had occurred, the Interstate Commerce Commission investigation brought out the fact that the roadmaster had not been over the line for a month, and then only in the cupola of a caboose. It was found on still another road that, although the roadmaster was in almost daily contact with his foremen, he was covering his territory by automobile on a highway paralleling the line, and saw nothing of the track except in the immediate vicinity of the gangs.

To anyone who knows the fidelity of the average roadmaster to his duty, such practices may be considered unusual. But the fact that these situations came to light on widely separated roads of better than average maintenance standards leads one to fear that they are not as unusual as might be thought. It will not be amiss, therefore, for general maintenance officers to check up on the practices of their local officers in this respect. It will also be advisable for roadmasters to ask themselves if they are doing their full duty in this direction.

New Opportunities for Treatment

ALTHOUGH the railways use large quantities of wood in the form of crossties, this by no means constitutes the sole or even their main requirement for timber, for in spite of the inroads that concrete and other materials have made in recent years, timber is still the most widely used railway construction material. Until recently it has been only in the case of crossties that preservative treatment has been extensively employed, with the result that in many applications its life has been short.

Because of the vast quantities of wood required for ties, the railways early developed the science of treatment with preservatives, and it has been an outstanding success. Because the capacities of the plants were required for the treatment of ties and because of the desirability of such volume output to the plants, the treatment of wood for other railway uses has received little attention with the exception of that entering into bridge construction. This has been due in part to failure by the railways to give serious consideration to the economies possible through the treatment of wood for miscellaneous uses. It has been due also to the indifference of treating plants to the treatment of this miscellaneous material, much of which requires individual framing in advance.

As the effects of the treatment of ties have been recently reflected in reduced requirements and have left the treating plants with surplus capacity, this attitude has changed, with the result that they are now actively soliciting the treatment of miscellaneous timbers. This opens new possibilities for many railway users of timber, a condition of which they should take advantage. They can now afford to analyze every project in which timber is being or can be employed, to ascertain whether economy will be promoted by the treatment of this material.

The Camp—A Neglected Opportunity

THE producer of a widely known brand of condensed milk has spent millions of dollars to establish in the minds of the American public the merits of milk from contented cows. Are contented workmen any less an asset to a railway? It is not many years since railway officers gave little attention to the condition of the camps provided for their floating gang employees if the labor turnover was not unduly large. While this turnover is of course, one index of the condition of a camp, it does not tell the entire story. Rather, a more accurate criterion is not that a camp is so bad as to cause men to seek employment elsewhere, but whether it is such as to make the men happy and willing to put forth their best efforts.

The railways go to great lengths to secure those materials that will give them the best service. They conduct exhaustive tests to establish the relative merits of competing products; they prepare elaborate specifications setting forth their requirements and they then subject these materials to detailed tests to insure that they comply with the provisions of these specifications. Yet all of these expenditures aggregate considerably less than the outlay for labor, which is bought without specification and with little attention to such details as housing which exercise such a marked effect on efficiency.

Contractors have long recognized that a good camp is an asset of no mean importance and they guard it most carefully. Some few railways appraise their camps on the same basis, but they are in the minority and as a class, railway camps leave much to be desired. The provision of camps with such modern facilities as steel bunks, shower baths, electric lights and quarters for recreation purposes, need not be justified by any intangible humanitarian motives. Excellent as these considerations are, it is not necessary to fall back on them, for such provisions can be fully justified on such well established business prin-

ciples as the attraction into service of a better class of men, the reduction of labor turnover and the increased output of contented healthy men.

In organizing a floating gang, a railway, of necessity, competes with other employers of unskilled labor and where they have any choice, the men naturally select that work which is most attractive to them, all things considered. One of these considerations is the camp.

Rail Laying Records

ONE OF THE most difficult maintenance of way operations to measure accurately, and yet one which is the subject of much direct comparison, is that of relaying rails. Many records are claimed. Much of the progress that has been made in the efficient operation and maintenance of the railroads of this country has been the direct result of this spirit of friendly competition.

Although many individual maintenance of way operations are capable of accurate comparison, this is not entirely true in the relaying of rails, with the many varying auxiliary operations. A "record," with respect to the quantity of rails laid per unit of time, must therefore be considered by maintenance men in the light of all the conditions surrounding the work.

Many instances of admirable performance in relaying rail have been reported in the past. The Canadian Pacific in 1923 reported the relaying of rail over a 100-mile stretch of track in Quebec at the average rate of a mile an hour, and at a maximum rate of as much as 10 miles a day, with a force of 257 man; the Chicago division of the Baltimore & Ohio, in 1925, reported that 426 rails were relaid by a force of 61 men in 203 min., or at the rate of one rail every 28½ sec.; the Chicago & North Western, in 1927, relaid rails at the average rate of 9,683 ft. a day, and as high as 12,480 ft. a day with a force of 185 men; this spring, a gang on the Pennsylvania relaid 301 rails in 101 min., or at the rate of about one rail each 20 sec.; and the Long Island, as recently as March of this year, relaid 302 rails in 331 min. with a force of 81 men.

Which of the above performances, all of which have been referred to as records, is truly the record? From the information given, or ordinarily available concerning work of this character, no one can venture an answer because, in spite of the fact that it appears that the Canadian Pacific and the Pennsylvania succeeded in actually placing rails in the track the most rapidly, it is recognized that, with all factors taken into consideration, including the working conditions, the amount and character of the work actually done, and the extent to which work equipment was used, the least startling performance may in reality be the most efficient performance.

Each particular rail-laying job referred to undoubtedly established a record on the particular road or division on which it was made. In fact, this is known to be the case in certain instances. However, just which road actually holds the record for laying rail will always be a matter of dispute. This is true, not because a fairly accurate determination of the speed and efficiency of various rail laying jobs cannot be made by intricate time-studies and cost accounting, but rather, because this, in all probability, will not be done generally.

In spite of this situation, attempts to establish rail-laying records will continue and claims will be made. This is as it should be, so long as speed and economy in getting the rails into the track are not obtained by sacrificing the quality of the work performed, which, in the end, might result in losses far in excess of any initial economies effected. With the expenditure for rails second only to that for ties, the first essential in laying them to insure that the work be done properly and safely. With this assured by adequate and competent supervision, the quest for speed and economy in rail laying operations cannot result in other than good, regardless of whether anyone can justly lay claim to the "record."

Putting It in Simple Language

ONE OF THE difficulties which confronts those who desire to introduce a new scientific principle is to describe it in such a way that it will be readily understood and, too often, those who advance the new idea appear incapable of putting it into simple language. Of course, it is not always possible to do this, especially if an attempt is made to cover the subject in minute detail and present all of the limitations or exceptions. However, until someone does hit upon a way of putting it into simple language, the new principle will not be generally accepted.

This can be aptly illustrated by the story of the water-cement ratio as the law for the proportioning of concrete. As is now well known, it was found that, other things being equal, the strength of concrete depends very largely on the amount of mixing water that is used with a given quantity of cement. There are, of course, certain limitations on the application of this principle; for example, it is necessary to take into account the amount of water that has been soaked up by the sand before it is put into the mixture. Therefore, it was at first considered necessary to employ a rather complicated mathematical routine in applying this rule to the proportioning of concrete.

It was soon discovered that this was too complicated for general acceptance, and the efforts that were made to devise simple methods met with considerable success. However, it was not until some time later that a really clear explanation was developed; namely, the conception of concrete as a mass of stone and sand held together by a cement paste.

Portland cement, like most other cements and glues, must be mixed with water to develop its cementing action and like such other cements, this action is greatest when a certain specific proportion of water is mixed with it. If there is not enough water, the full effect will not be obtained because all of the particles of cement will not be brought into action. If there is too much water, the paste will be too thin and the water not required for chemical action, will remain as unabsorbed drops which will appear as small voids when this excess water has evaporated.

To make concrete, it is necessary to add to a given amount of sand and stone, enough water-cement paste of the proper consistency, so that when they have been thoroughly mixed together, the entire mixture will hold together in a compact mass that will not separate while it is being transferred from the mixer into place in the forms. In other words, it must form a workable mix. Therefore, all that one needs to do to make concrete approximating

a given strength, assuming the materials are of good quality, is to add the specified amount of water to the cement to produce a paste of the required strength, and mix this paste with sand and stone so as to obtain a workable mix. This is easily done, but the mixture so made may not be the most economical one; in other words, it may not produce the greatest possible amount of concrete per sack of cement. This may be done mathematically with the aid of a screen analysis of the stone and sand, but substantially the same result may be obtained by making a series of trial mixes—varying the proportions of fine and coarse aggregates until the maximum proportion of total aggregates is obtained that still produces a workable mix.

Once these simple principles are understood, most of the mystery is taken out of the water-cement ratio, and it is not without reason to anticipate that in the future the amount of water per sack of cement and the measure of workability of the mixed concrete will be the two prime requirements in instructions or specifications for concrete work.

An Unusual Opportunity for Standardization

IT IS an established principle of business that no individual or company can attain success without definite plans for the future. So, in providing new facilities, such as a store, a factory or a new line of railroad, for example, it is necessary to consider not only the immediate needs, but those of years to come as well. However, it is also an accepted principle of good business that the expenditure for any improvement should be no greater than that necessary to meet current needs, except as may be necessary to insure that work done now will fit into a plan for future enlargement or improvement.

It is for this reason that railroads in more recent years have been built to higher standards of grade and alinement than could be justified, in many cases, on the basis of the business immediately available. Future reconstruction to improve standards would too often require the building of an almost entirely new line and the original line with its embankments, cuts and bridges, would be worthless. But this is not true of the auxilliary facilities, such as station buildings, roundhouse and water stations. There are many reasons why it is generally found most expedient to build these of such capacities and standards as will be adequate only for the needs of the immediate future, permitting the developments of later years to determine what increases in requirements are needed.

Occasionally lines are built under circumstances which insure a large volume of traffic as soon as they are completed. In such cases, all facilities must be of a character, both as to efficiency and capacity, as are needed for the effective operation of any seasoned railway with an established traffic.

Such were the circumstances attending the construction of the Illinois Central's Edgewood line. As it was built to serve as an alternate main line between Edgewood, Ill., and Fulton, Ky., to supplement the older line between those two points, it was possible to determine with a reasonable degree of accuracy the volume of traffic which it would carry as soon as the track was in condition for regular service and for a number of years in the future. It was, therefore, just as important to provide adequate yards, engine terminals, signals and water facilities, as it was to provide suitable grades and alinement.

How the problem of water supply was attacked and solved, is clearly shown in the article on page 204 of this issue. Because the line is 169 miles long, it will be readily realized that the matter of water supply alone was an engineering project of no small magnitude. The work, also, had to be done without the intimate knowledge of the sources of water, stream flow, etc., possessed by the officers of an existing railway by reason of long, intimate contact. Of especial interest is the fact that full advantage was taken of the opportunity to effect a high degree of standardization in the details of the facilities, particularly the pumping equipment.

The advantages and disadvantages of standardization, and its influence on economy on the one hand and advance in the art on the other hand, need not be discussed here. It suffices to say that standardization, as confined to the division or some other operating unit of a railroad, is unquestionably an influence for greater economy. The difficulty of effecting such standardization under ordinary circumstances arises from the fact that water supply facilities on a line of slowly growing traffic are themselves subject to slow growth, as explained above. Consequently, standardization can be attained only by consistent adherence to a well-laid plan over a considerable period. Even then, changes in requirements, improvements in equipment or other considerations often upset the plan before it is completed. These obstacles did not lie in the way of the Illinois Central with respect to its Edgewood line, and its officers are to be commended for taking full advantage of the opportunity.

New Books

Proceedings of the American Railway Bridge and Building Association. Edited by C. A. Lichty, secretary of the association. 274 pages, illustrated, 6 in. by 9 in. Bound in cloth and paper. Published by the association, 319 North Waller avenue, Chicago.

This volume contains the complete report of the thirty-eighth annual convention of the association, held in Boston, Mass., on October 23 to 25, 1928. The contents, as in previous years, are comprised mainly of eight committee reports, together with the discussions which followed their reading at the various sessions of the convention. The reports this year covered the following subjects: Jacking and Tunneling Culvert Pipes, The Use of Motor Cars, The Co-operation Between Stores and Field Forces, The Control of Motor Car Operation, Painting, The Organization and Equipment for Emergency Bridge and Building Work, The Maintenance of Water Stations, Concrete Unit-Built Slabs. In addition, papers were presented by H. I. Benjamin, assistant engineer of bridges of the Southern Pacific, Pacific system on The Suisun Bay Bridge; by W. T. Krausch, engineer of buildings, Chicago, Burlington & Quincy, on the Wrecking and Salvaging of Buildings; and by W. J. Backes, chief engineer, Boston & Maine, on The New England Flood of 1927.

GRADE CROSSING ELIMINATION.—A total of 390 railroad grade crossings were eliminated from the federal aid highway system in 1928, according to a statement by the Bureau of Public Roads of the United States Department of Agriculture. Of the 390 crossings, 283 were done away with by relocation of highways.

Better Outfit Cars—Better Men?

Does it pay to provide improved camp facilities for floating gangs? This survey of the field provides the answer

THE ramshackle and leaky box cars, which formerly comprised the facilities for housing maintenance of way forces on many railways, are rapidly fading from the picture and in their places are to be found clean, well-maintained cars in which attention is given to sanitation, ventilation, light and comfort; cars in which the men may not merely sleep, but in which they can spend their evenings or off days in reading, visiting or playing games. The wooden, vermin-breeding bunks of other days are likewise giving way to steel bunks with wire springs, and the cars are being inspected regularly, are screened to keep out flies, mosquitos and other flying insects, and are fumigated at regular intervals to rid them of vermin.

This trend toward improved conditions has not been a matter of sudden growth, although it has been accelerated considerably in recent years to keep pace with the generally higher standard of living in the country as a whole, thus enabling the roads to secure a better class of workmen. In this respect, the racial characteristics of the people from whom the labor is drawn must be taken into account, so that the improvements, while general, take on different phases in individual cases or in different parts of the country. Other factors are the growing practice of programming maintenance work to afford continuous employment and the increasing use of labor-saving machinery, which enables a gang of a certain size to perform more work, thus reducing the number of men required. This latter influence has operated diversely as between roads, the tendency in some cases being to do away with floating gangs except in emergencies, while other roads are approaching the other extreme and expect eventually to carry on most of the track maintenance with such gangs, leaving only the policing of the roadway and minor details of track work to skeleton section gangs with permanent headquarters.

The Practices of 40 Roads are Reviewed

To present a representative cross-section of practice in the make-up and details of these outfit cars, information was obtained from 40 railroads in the United States, comprising some 133,500 miles of line, or more than 50 per cent of the total of the country, as well as from the two major Canadian systems with a total of more than 35,000 miles. On the information so obtained, the following review of the subject has been based.

Almost without exception, the replies to a questionnaire prepared to bring out the salient points refer to the desirability of conforming to the racial or social habits of the men to be taken care of, and the extent to which native "white" labor can now be secured in all but the South and Southwest and around some of the industrial sections in the East. Thus, the Great Northern and the Northern Pacific, traversing what were formerly sparsely-settled areas, which necessitated the importation of men from outside sources for section as well as floating gangs, are now able to secure most of their track labor from the residents along their lines. This change has not only worked to the advantage of the railways in supplying them with workmen who have a stake in the country, but is also of benefit to the communities along their lines in furnishing employment to men who might otherwise find it difficult to obtain work during slack seasons. Similarly, the New England roads, by maintaining comfortable, well-equipped outfit cars, are able to attract and hold a desirable class of men in their extra track forces and in bridge and building crews. On the Southern roads, which usually employ negro labor in their track gangs and sometimes in their bridge and building forces, the

One of the most striking features of maintenance of way work in recent years has been the trend to native "white" labor in many parts of the country, which began at a time when it seemed that this field was to be preempted by foreigners differing, both physically and mentally, from those on whose shoulders fell much of the burden of the construction and maintenance of the American railways in the earlier days. While several factors have been involved, there is no question but that proper housing has been of great influence.

main points to be observed are to see that the cars are clean and that the men are given plenty of plain, substantial food, since this class of labor cares little for other comforts than these.

Marked improvements have been made in the classes of cars used for housing the maintenance forces. The utilization of passenger cars of obsolete types for this purpose is increasing rapidly, while the box cars, where this class of equipment is used, are now largely 40-ft. cars, refloored, ceiled and painted on the inside, and equipped with steel bunks to accommodate from 6 to 10 or 12 men, thus preventing overcrowding and leaving a lounging place for the occupants. The cars are usually screened and are often insulated as a protection from both heat and cold, this latter provision ranging from a lining of building paper under the ceiled surfaces to the use of special insulating materials. On the Great Northern

Camp-car outfit on the Delaware, Lackawanna & Western

and the Northern Pacific, where the winters are often intensely cold, refrigerator cars have been converted into outfit cars for forces which are maintained during the winter.

What Has Happened to the Box-Car Outfits?

A typical boarding car outfit of the better class is exemplified by the equipment furnished for extra gangs by the Chicago, Burlington & Quincy. For this purpose, 40-ft. cars are selected and cars with steel center sills are being used to an increasing extent. A camp outfit for a gang of 50 men is composed of the following cars:

It has been truly said that three elements are necessary to obtain and keep a good class of labor: Good food, clean sleeping accommodations and facilities for personal cleanliness, and that where these are provided there is usually little trouble in keeping the forces recruited with little turnover. This article is the first of a series dealing with the methods adopted by the railways for housing their maintenance of way forces, either fixed or mobile, and the results which have been attained by the carrying out of these policies.

1 Foreman's car
5 Bunk cars
1 Dining car
1 Kitchen car
1 Supply car with refrigerator
1 Commissary car
1 Water supply car
1 Tool car

When these cars are taken into the shops to be fitted up, they are refloored and lined on all sides, as well as above, building paper being placed under the lining for insulation. The windows are cased and screens are maintained at all doors and windows. The cars are painted both inside and outside, lead color being used inside, and are repainted and cleaned as frequently as necessary to keep them in good condition.

The bunk cars contain five double-deck steel bunks, arranged as shown in the accompanying floor plan, leaving a large floor space which can be used as a lounging room, when the men are off duty. A table, 30 in. wide by 5 ft. long, and two benches are supplied to each car for reading or other amusements. It has been the experience on that road that men who are congenial usually occupy the same car, and since each car is provided with sufficient lounging room for its occupants, no general lounging car is necessary. The fittings in the other cars are so arranged as to adapt them most efficiently to their respective functions. The supply car is provided with a refrigerator with inside dimensions of about 10 ft. by 8 ft. for the storage of meat and other perishable food. The foreman's car contains a dining compartment, 11 ft. long, while the remainder of the car is supplied with two double-deck steel bunks, and with a table and benches for use in making out reports, reading, or such other purposes as may be desirable.

The outfit cars on the Chicago, Rock Island & Pacific are similar in arrangement and differ only in minor details from those on the Burlington, the principal point of difference consisting in the use of insulating felt instead of building paper under the lining. The Denver & Rio Grande Western also has very complete plans for the various units of its camp-car outfits.

The Nashville, Chattanooga & St. Louis has prepared standard plans for its floating-gang cars, which consist of the following: a foreman's car, bunk cars housing 12 men each, a combined kitchen and dining car and two tool cars, one fully enclosed while the other has an enclosed portion 19 ft. long, with the rest of the deck open. Double-deck steel bunks are used and no bathing facilities are provided, but a lounging room, lighted by one 300-candlepower lamp, is available for reading or lounging only. Folding toilets, placed over pits, are set up when the cars are to stay at one place over 48 hours.

The New York Central equips box cars for its extra gangs. These are lined and are painted on the inside with a two-color arrangement on the end and side walls. Single-deck steel bunks are used and up to

eight men are assigned to each car. These cars are sometimes used at permanent or semi-permanent camps similar to the one at Kings Bridge in the Bronx section of New York, which was described in the July, 1928 issue of *Railway Engineering and Maintenance,* and when so used are lighted by electricity. In the camp-car outfits which are moved from place to place, wash cars are provided and portions of the outfit are left free for lounging purposes.

The Chicago, Indianapolis & Louisville, the Denver & Rio Grande Western, the Great Northern, the Southern Pacific, and the Texas & Pacific are among the roads which have improved the details of their box-car outfits. The first-named road is gradually providing shower baths, sanitary toilets, and other facilities, while the Great Northern has retired all 33-ft. cars from this service, replacing them with larger cars, which provide more room and air. The Ann Arbor has improved its outfit cars by greater attention to screening, ventilation, and by assigning not more than 12 men to a car. All outfits on this road are provided with a lounge or game room and outside toilets are built over sanitary vaults for its extra gangs.

The Southern Pacific has given considerable attention to its camp-car facilities. On the Texas and Louisiana lines, more attention has been given to ventilation and screening and also to the improvement of kitchen and dining cars. On the southern portion of the Pacific Lines, where Mexican labor is employed largely, the men will usually stay longer if they are allowed to have their families with them, and enough cars are sometimes furnished to permit this to be done.

On the Canadian National, which houses from 7,500 to 10,000 men in its extra forces, the cars have been equipped to withstand cold weather, and are provided with roof ventilators. Windows and doors are screened and double-deck steel bunks are used. No shower baths or recreational facilities are provided, but outside portable toilets are installed.

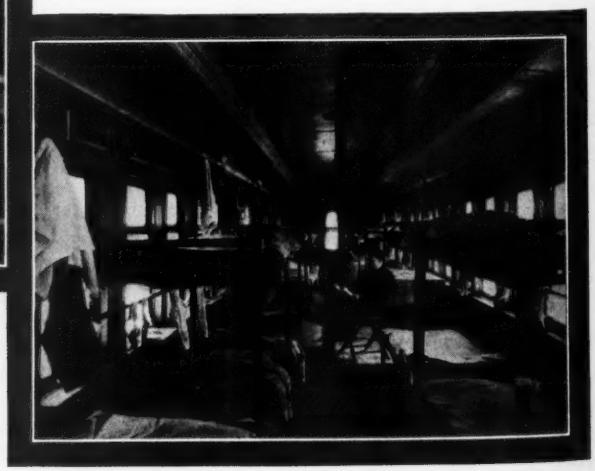
The utilization of refitted passenger cars of obsolete type for extra gangs is becoming more common than formerly. Probably the highest mark reached with this class of equipment has been attained on the Delaware & Hudson, where these cars are furnished for all floating gangs in the maintenance of way department. A description of these cars, together with a description of an outfit constructed by the Kansas City Southern for a pile-driving crew will appear in the following issue. It is worthy of note that the K. C. S. advises that while it will construct similar outfits for other of its bridge and building forces, it has made no provision for furnishing such cars for floating track gangs, since it is its intention that all track work will be done eventually by section forces. In this connection, the Chicago & Eastern Illinois states that it has had no floating track gangs for several years.

The Erie and the Delaware, Lackawanna & Western are now furnishing converted passenger cars for all of their extra gangs, the former road having replaced its box-car outfits with this type of car within the last two years. A typical train for a gang of 100 men on the Erie consists of a combined kitchen and wash-room car, one dining car, one combined dining and store car, and five sleeping cars equipped with 10 double-deck steel bunks to accommodate 20 men in each car. In the sleeping cars the alternate windows are blanked and the remaining ones are frosted. Heat is provided by a stove at each end of the car, and the cars are long enough to provide a space at each end to serve as a lounging place.

Bathing Facilities Are Provided

The wash-room is placed adjacent to the kitchen, from which it is separated by a tight partition, so that hot water will be available from the heater connected with the range. Four shower baths and 14 fixed wash bowls are provided, the water being supplied from an elevated tank filled by a gasoline-driven pump housed in one corner of the room. Where it can be done, the pump is connected to an outside supply of good water from a well or spring, but where these are not available, it is taken from a locomotive tank which forms part of the outfit. All of the cars are lighted by large kerosene ceiling lamps and are kept well painted, both inside and out. Outside toilets are provided except at such places where chemical toilets are required by state laws.

The Lackawanna, for gangs of from 20 to 35 men, supplies a combination kitchen and commissary car, a dining car, and one or two sleeping cars. For larger gangs, the equipment consists of a kitchen car, a commissary car, one or two dining cars, and as



Interiors of Lackawanna camp cars
Above—A commissary car
Right—Old passenger equipment used as a bunk car

many sleeping cars as are necessary to provide space for the men in the gangs. Baggage cars are refitted for use as kitchen, dining and commissary cars.

The Southern Pacific has steadily improved its camp-car outfits and the utilization of old passenger cars for extra gangs is increasing. On the Pacific Lines, a considerable percentage of these cars are equipped with shower baths and with hot and cold water for the wash sinks, while single-deck steel bunks have been approved recently as standard. While box cars are used for extra-gang bunk cars on the Texas and Louisiana Lines, better facilities have been furnished the foremen by providing them with cars converted from old passenger or baggage cars, and shower baths have been installed in a few of these cars. More attention is also being paid to ventilation and screening throughout.

On the Boston & Maine old passenger cars are used for extra gangs and the outfit cars are maintained to better standards than formerly. No shower baths are provided, but wash sinks are now installed as the cars are fitted out, and the coach toilets are left in place. Practically all crews have a lounge car for recreation. The Maine Central also uses passenger car equipment and provides lounging cars for its larger gangs.

On the Pennsylvania, where only a small proportion of the total force employed in track work is housed in outfit cars, these cars are better equipped than formerly, and are provided with shower baths, sanitary toilets, and lounging rooms.

Outfit Cars for Bridge and Building Forces

While the cars furnished for the bridge and building forces have always been of better class than for the extra track gangs, their improvement during the last few years has been marked by the use of better cars than formerly, as well as by the introduction of shower baths and other comforts. Thus the Ann Arbor and the Bessemer & Lake Erie have refitted old Pullman cars for this purpose. On both these roads, sufficient Pullman berths are left in place for sleeping purposes, while on the former, shower baths, sanitary toilets and lounging rooms are provided.

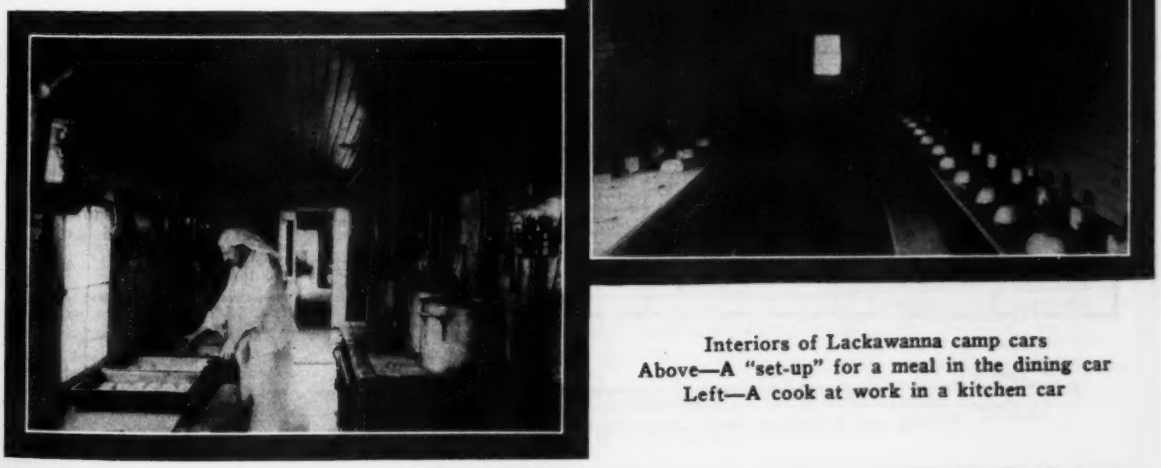
On the Erie, the bridge, building and signal gangs are housed in coaches similar to those for the track gangs, which have been described, but modified in arrangement because of the smaller number of men to be cared for. Two cars are usually furnished for each gang: a combined kitchen, dining and washroom car and a sleeping car with one end partitioned off to serve as an office and sleeping room for the foreman. The tool and material cars furnished these gangs are flat cars and box cars, painted in harmony with the coaches.

On the Denver & Rio Grande Western the outfit cars for bridge and building forces consist of passenger cars refitted to standard plans. For these gangs, a bunk car, a combined dining and kitchen car, and a commissary car are furnished. The sleeping car contains eight double-deck steel bunks, and double wash bowls are provided at each end of the car. The commissary car is divided into three compartments, the foreman's office and sleeping quarters occupying one end of the car, and the cook's quarters the other end, while the commissary is in the middle of the car. The Lehigh Valley provides shower baths for its men wherever possible, and also provides a lounging room for the bridge and building, signal and telegraph forces.

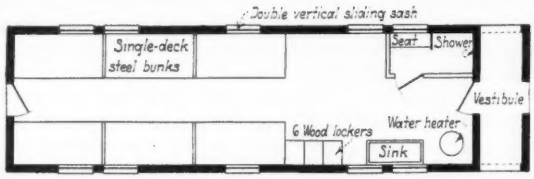
The Gulf Coast Lines of the Missouri Pacific have standard plans for refitting coaches for their bridge and building forces. These comprise a combined dining and sleeping car, a combined foreman's and kitchen car, and also a dining car for pile driver gangs, in which provision is made for conductor's quarters and for a recreation room. The Texas & Pacific also provides cars of the passenger coach type for its bridge and building forces. Some of these cars were built originally for camp cars, while others are remodeled from equipment which has become obsolete for passenger service.

Arrangements for Feeding

On most of the roads, the extra gangs are fed by contract with commissary companies, while the bridge and building forces and similar gangs, including small track gangs in outfit cars, either arrange to board themselves by a co-operative arrangement, or are boarded by the foreman at an agreed rate. On some roads, where co-operative arrangements are in effect, the railway provides the kitchen and dining equipment, furnishes and pays the cook and, in some instances, also furnishes or pays an



Interiors of Lackawanna camp cars
Above—A "set-up" for a meal in the dining car
Left—A cook at work in a kitchen car



Bunk car with shower bath, Southern Pacific

orderly to take care of the car and assist the cook. On the Santa Fe, the bridge and building forces are fed by contract or are boarded by the foreman, as they prefer. In the extra gangs, where almost all of the laborers are Mexicans, the foremen and men board themselves, obtaining supplies of food from commissary contractors. Similar arrangements are in effect among Mexican gangs on the Southern Pacific in Texas and the Southwest, and on the Texas & Pacific, where the extra gangs are made up almost exclusively of this class of labor. On the Missouri Pacific, the gangs have the option of being fed by contract or of boarding themselves. If the latter course is adopted, food is secured from the commissary contractor.

On the Burlington, the extra gangs and other floating track gangs, as well as unusually large bridge gangs, are fed by contract almost exclusively, although a few such gangs prefer to board themselves. In the ordinary bridge and building gangs, the dining arrangements are either run by the foreman or some member of the force, who charges the men for their board, or the commissary is run on a strictly co-operative basis as may be preferred by the individual gangs.

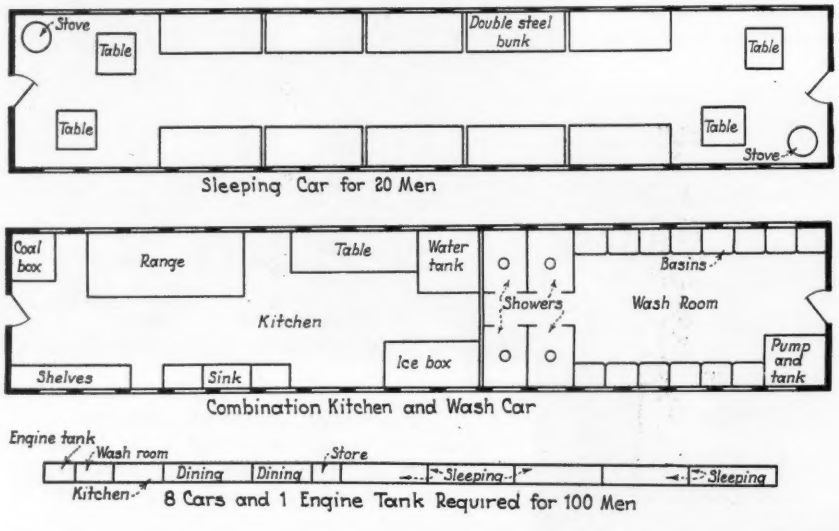
Comparatively few roads handle the feeding of the men through their own commissary or similar departments. Among these may be cited the Lackawanna, where the dining arrangements are placed in charge of the labor supervisor of the road. The Central of Georgia feeds its extra gangs through a commissary which provides all equipment and food, as well as a cook, the charges for meals being fixed to cover the cost of the food only. For the bridge and building forces and similar gangs, the railway furnishes a cook and equipment and the men supply their own food by a co-operative arrangement. Similar methods are employed on the Bangor & Aroostock and the Lehigh & New England. On the Great Northern, the contract system prevails on a portion of the system and a company commissary on the remainder.

N. C. & St. L. Has Complete Commissary System

The Nashville, Chattanooga & St. Louis has adopted a very complete system of operating the dining facilities of its camp cars, which was described in detail in the December, 1920, issue of the Railway Maintenance Engineer, the former name of the present *Railway Engineering and Maintenance*. All food, except dairy supplies, which include fresh meat, butter, eggs and milk in fixed allowances, is purchased by a railway commissary agent and shipped to the different gangs as needed, and the boarding of the men is handled in accordance with printed rules. In the circular issued at the time the plan was inaugurated on October 18, 1918, the duties of the commissary agent were defined as follows:

(1) To adopt the most economical methods of purchasing and distributing.
(2) To keep in touch with the different departments, by personal investigation, to see that no waste is occasioned in handling at the point of consumption.
(3) To see that the cook and dining cars are kept in a sanitary condition.
(4) To keep a check on all requisitions to see that they conform to the balanced ration and subsistence reports.
(5) To understand that he has no authority to issue orders to employees in the above departments, but is to act in an advisory capacity, and when conditions needing correction are not given prompt attention, to report the facts to the purchasing agent.

Under the arrangement, one cook is assigned to gangs of 15 men or less, and two cooks for gangs of 30 men or more. When the gang ranges in size from 15 to 30 men, the cook is allowed extra help from the laborers, in accordance with the size of the gang. The commissary agent makes inspections of the outfits from time to time, reporting results to the purchasing agent and the chief engineer, and also to the superintendent and the division engineer of the division on which the cars are located. The charge for board is based on the cost of the food and the cook's wages, and has resulted in



Plans of typical camp cars in use on the Erie and a layout for a gang of 100 men

Each bunk car has a lounging space at the ends. The wash room contains four showers with hot and cold water

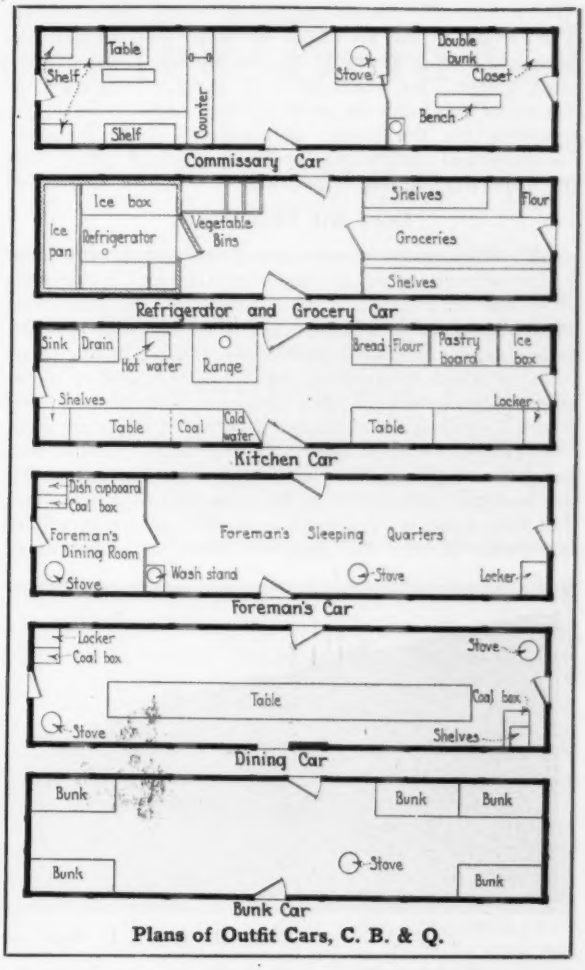
the men being better fed at less cost than they would be under any other arrangements.

While supervision to insure cleanliness and sanitation in outfit cars is usually entrusted to the roadmasters or other supervisory officers, as was the custom in the past, more attention is being paid to these details and some roads have delegated this duty to certain employees as a special matter. On the Boston & Maine, the facilities are inspected by the supervisor of work equipment and his staff. The Central of Georgia has a commissary clerk who makes frequent rounds of the extra-gang outfits to see that sufficient nourishing, well-prepared food is served the men, and, as with the Nashville, Chattanooga & St. Louis, finds that the men are better satisfied than under the system in vogue before the present plan was instituted.

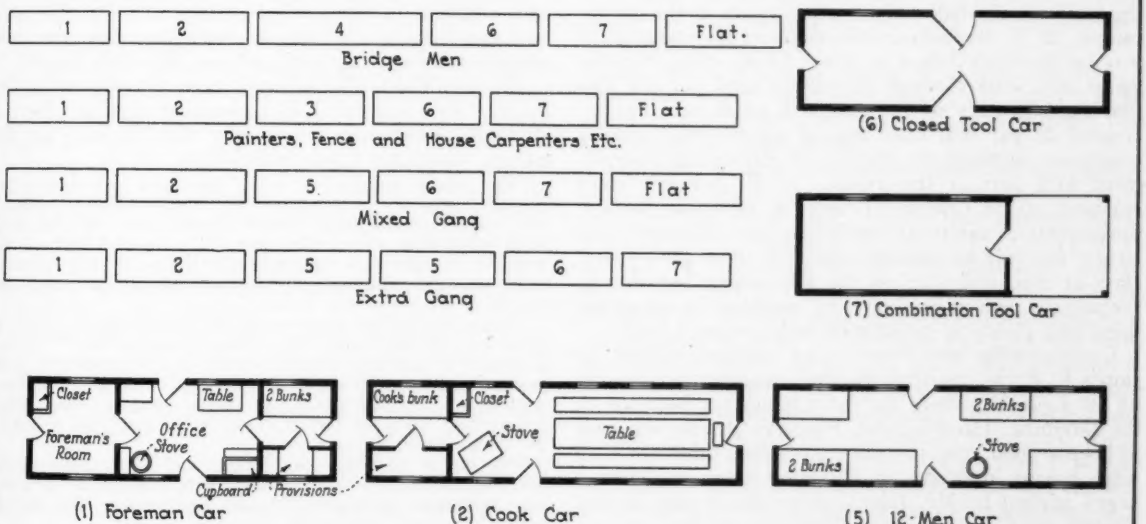
On the Rock Island, the division engineer and the master carpenter inspect the outfit cars regularly and the engineer maintenance of way visits them as often as he can, calling attention to unsatisfactory conditions, or commending when conditions are unusually good. In malarial districts, water holes are drained or oiled, and the drinking water is inspected to see that it conforms to the U. S. Public Health regulations, a sanitary force being maintained in Arkansas, Louisiana and Eastern Oklahoma to look after these details.

On the Erie, frequent inspections are made by the general officers to supplement those made by the division officers, and a similar practice exists on the D. & R. G. W. The Florida East Coast employs a sanitary inspector to supervise sanitary conditions, while the Pennsylvania provides a camp supervisor where necessary.

The Missouri Pacific has rigid requirements as to the maintenance of sanitary conditions, which are looked after by the roadmaster and the supervisor of bridges and buildings in their respective forces. All outfit cars are thoroughly fumigated once a year with calcyanide. On the Texas & Louisiana Lines of the Southern Pa-



Plans of Outfit Cars, C. B. & Q.



Plans of Outfit Cars, N. C. & St. L.

Standard plan for outfit cars used by the N. C. & St. L. showing method of assembling them for various classes of gangs

cific, a traveling fumigating outfit, using cyanide gas, is maintained and an effort is made to fumigate all camp cars twice a year. On the Pacific Lines of the same system, the eradication of vermin is placed in charge of one man on each division, who is held responsible for the proper fumigation of all company dwellings and camp cars, for screening against flies and for inspecting sanitary conditions.

Does All This Pay?

All of the roads which have given serious attention to the betterment of the facilities for their extra and other floating gangs, are unanimous in saying that these efforts have resulted in benefits that far outweigh the expenditures, making it possible to secure a better class of labor which remains on the job longer and is more efficient by reason of this fact, and also because the men are well fed and have opportunity to obtain rest at night in clean, comfortable quarters. While this conclusion is reached in all such cases, the extent of the benefits cannot always be allocated definitely, but that they exist is shown on a number of roads whose experience is that the gangs in their best maintained camps are of better quality and are more efficient, while the turnover is smaller than in the gangs at the poorer camps. F. T. Beckett, district engineer maintenance of way on the Rock Island at Reno, Okla., states that the gangs now work through the season until laid off, and that the efficiency of the gangs in outfit cars has increased 25 per cent over that of gangs under former conditions, although he credits the Eighteenth Amendment with part of this result. C. E. Weaver, chief engineer of the Central of Georgia, says that the improvements in camp-car conditions have increased efficiency, not only by making it possible to secure a better class of men who stay on the job longer, but also by keeping the men in good physical condition by providing them with plenty of substantial, well-prepared food.

Corroborating this view is an incident related by James F. Burns, assistant engineer maintenance of way of the L. & N., where the extra gangs are boarded by the foremen. On this road, Foreman Brooks was able to keep a good gang even at times when other foremen were having difficulty in obtaining men, so when a negro applied to Mr. Burns' office for a pass to Mr. Brooks' gang, he was asked "Why do you boys always want to go to Mr. Brooks' gang?" "'Cause he feeds so good" was the reply.

B. A. Wood, chief engineer of the Mobile & Ohio, also testifies to the influence of camp-car conditions on the improvement of the quality of labor, saying that many negroes in bridge gangs on the southern end of that road have service records of from 10 to 20 years.

Similar results have been shown on the New England roads. P. C. Newbegin, chief engineer of the Bangor & Aroostook, advises that good outfit cars have made it possible to obtain men locally who depend on that road for employment every season. Similarly, on the Maine Central, C. S. Robinson, engineer maintenance of way, says that the maintenance of camp cars in good condition has made it possible to obtain and retain a high class of local labor. Men with from 10 to 25 years' service are not uncommon in the bridge, masonry and painting crews, while in the extra gangs, a considerable percentage of the men have worked from two to five consecutive seasons.

Essentials in Keeping a Good Class of Labor

It is the experience of I. H. Schram, engineer maintenance of way of the Eastern district of the Erie, that three elements are necessary to obtain and keep a good class of labor: Good food, clean sleeping accommodations, and facilities for personal cleanliness. When these are provided, the men stay at work, or, if they leave for a few days in town after payday, will return to the gang. In addition, well-kept outfit cars remove the eyesore of unkempt facilities and create a better impression on the public. A. J. Neafie, principal assistant engineer of the Lackawanna, also finds that with well-maintained, comfortable outfit cars, the men will usually return to the work after a few days' layoff.

Rock Island B. & B. Outfit on Left, Extra Gang Cars on Right

Bernard Blum, chief engineer of the Northern Pacific, is also convinced that camp-car facilities have a decided influence on the quality and efficiency of the gangs, stating his views as follows:

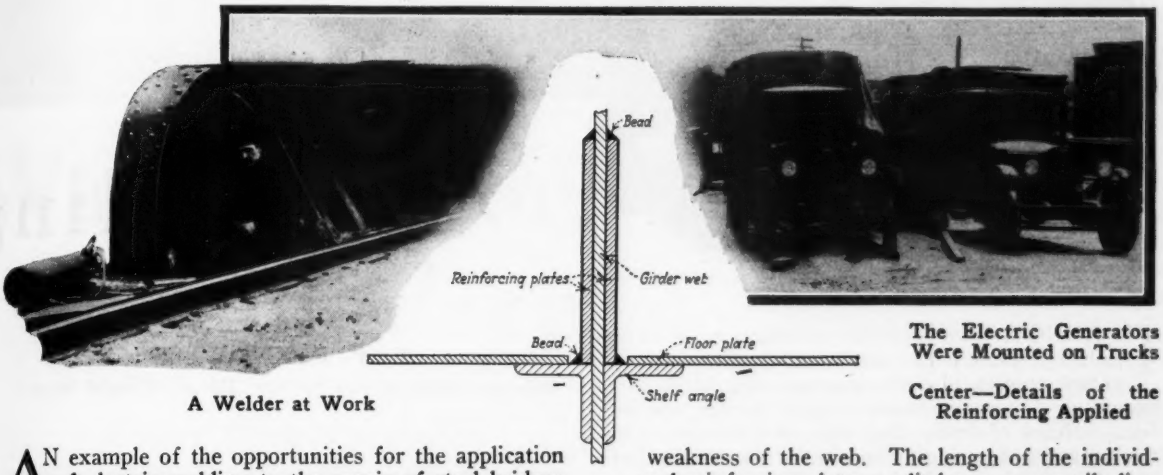
"The general standard of living demanded by workmen has become higher in recent years and railway officers recognize that employees are more efficient, better contented and more loyal when they are housed and fed properly. Where the turnover is high, work cannot be done efficiently and economically, and the standard of a camp determines largely the length of service of the men.

"The policy of the Northern Pacific is to employ, as far as possible, men who make their homes along its lines. The employment of such men during slack periods on the farm or in industry improves the economic condition of its patrons, whose welfare greatly influences the prosperity of the railway. Such employment fosters a feeling co-operation and helps to stabilize conditions in the community.

"As far as possible, maintenance and improvement work are programmed to permit the continuous employment of gangs who will thus enjoy steady wages and provide the railway with well-trained men, to the advantage of both."

M. S. Blaiklock, assistant chief engineer of the Canadian National, also advises that good camp outfits have a large influence on the labor turnover, and says that this is borne out by the fact that in a number of cases the same men return every year. Efficiency depends to a large extent on satisfied men, and the railway's efforts to see that the men are well fed and otherwise taken care of are well repaid by the results obtained.

C. & N. W. Repairs Bridges by Electric Welding



A Welder at Work

The Electric Generators Were Mounted on Trucks

Center—Details of the Reinforcing Applied

AN example of the opportunities for the application of electric welding to the repair of steel bridges is afforded by work done during the past winter on 12 track-elevation bridges of the Chicago & North Western in Chicago. This work was strictly in the nature of repair, since it embodied the application of new material solely for the purpose of overcoming losses resulting from corrosion, rather than for the purpose of reinforcing or strengthening the bridges to increase their load-carrying capacity over that provided in the original design.

The bridges in question are of the earlier type used in track elevation work in Chicago, namely, through-girder spans, in which a special effort was made to reduce the floor depth to a minimum. In this construction, each rail rests on a longitudinal plank, carried in a special form of shallow stringer which is supported by shallow floor beams spanning between the bottom flanges of the girders. This entire floor system is covered between the rails, and between the rails and the girders by thin steel plates as a protection for the streets and sidewalks below. These plates are fastened to the floor members by rivets and are also secured where they terminate against the webs of the girders by being riveted to small shelf angles which are in turn riveted to the webs of the girders.

By covering the floor plates with mastic waterproofing and renewing this as found necessary by inspection, it has been possible to protect the floor plates from serious deterioration. However, it has been found that rain water falling on the floor or the condensation from steam blown against the girders, is held for considerable periods in the corners where the floor plates join the girder webs, and this condition, together with the natural tendency for cinders to accumulate in those places, has resulted in serious corrosion of the girder webs just above the floor level.

To remedy this condition, it was decided to reinforce the webs by welding plates 7 in. wide by ⅜ in. thick against the webs just above the floor plates, (that is, against each side of the webs of intermediate girders and the inside of outside girders) at all points where the loss of metal was sufficient to cause appreciable weakness of the web. The length of the individual reinforcing plates applied was necessarily limited to the distance between stiffeners and varied from 5 in. to 5 ft. 1 in. The number of plates applied to the individual bridges varied from 2 to 64.

The primary equipment for this work consisted of two Wilson gas-engine generator sets, with a capacity of 275 amperes, mounted on motor trucks. The truck mounting was particularly convenient for moving from street to street, and in most cases, the trucks were parked in the street under the bridge while the work was in progress. In one or two places it was possible to run trucks on the track level and spot them close to the bridge. Other equipment included an oxy-acetylene torch for cutting.

The force employed consisted of two welders, a helper and a flagman or watchman. The latter was an essential unit in the force, his primary duty being that of warning the men of trains.

The first step was to clear the places for the application of the new plates. This included the removal of any paint and loose rust or scale that adhered to the webs of the girders, and the use of the cutting torch to burn off the edges of the floor plates far enough away from the web so that the new plates could be set down on the shelf angle and allow room enough for a weld bead in front. To remove the paint, the torch was used to burn it to an ash, which was scraped off.

After the surface was cleaned, the plate was set in place and braced against movement, after which a continuous ⅜-in. bead weld was applied to all four edges. On the top and the two sides of the plate, this bead was applied in the angle between the plate and the web of the girder, while on the bottom the reinforcing plate was welded to the shelf angle, rather than to the web, the reason for this being that to be effective, the plates had to be set so low that it would have been practically impossible to apply a good bead beneath the under edge of the plate. Both $\frac{3}{16}$-in. and ¼-in. welding rods were used in the work.

The welding was done by the Anchor Welding Service, Inc., Chicago, under the supervision of O. F. Dalstrom, bridge engineer of the C. & N. W.

Building

By C. R. KNOWLES
Superintendent Water Service, Illinois Central System

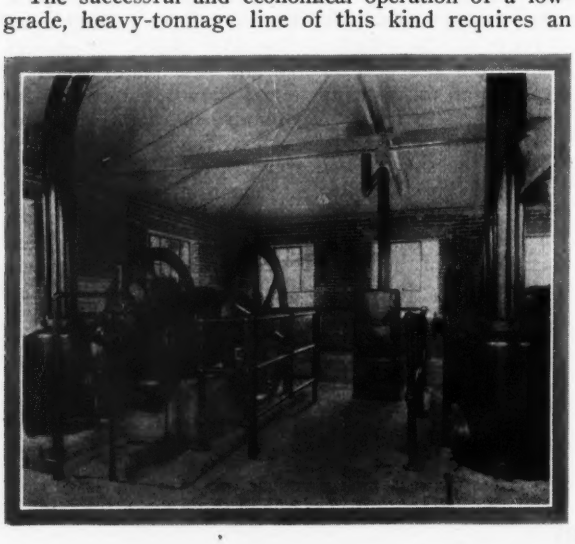
IT IS NOT often that the completion of a new railway, embracing as much territory as an entire engine district, imposes the problem of providing a complete water supply system adequate for a volume of traffic that may, in a few years, tax the capacity of a single track. Yet this is the problem that was imposed when the Illinois Central built its Edgewood cut-off. This line is 169 miles long, and embraces all of one engine district and a considerable part of another. It extends from Edgewood, Ill., to Fulton, Ky., traversing nine counties in southern Illinois for a distance of 127 miles, crossing the Ohio river at Metropolis, Ill., and passing through three counties of western Kentucky for a distance of 42 miles.

Built to serve as an alternate main line, the anticipated volume of traffic to be moved over it was sufficient to justify a 0.3 per cent grade with maximum curvature of 1½ deg. For the same reason, it was necessary to make provision for water supplies of far greater capacity and to a higher standard of construction than are ordinarily required on a new line of comparable length.. Also, the fact that new facilities were required throughout afforded opportunity for standardization to a degree not ordinarily practicable.

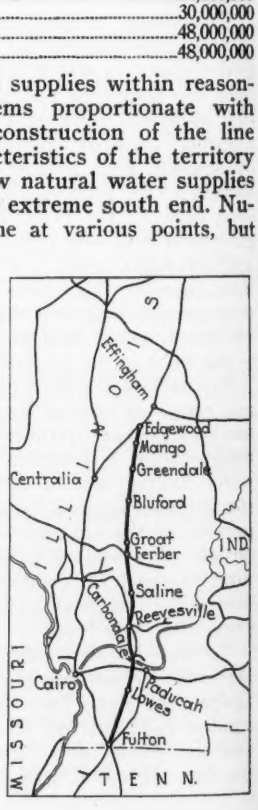
The successful and economical operation of a low-grade, heavy-tonnage line of this kind requires an ample supply of good water at stations properly spaced and located at convenient points. The total annual requirements for water were estimated at 336,000,000 gal., divided among eight water stations as follows:

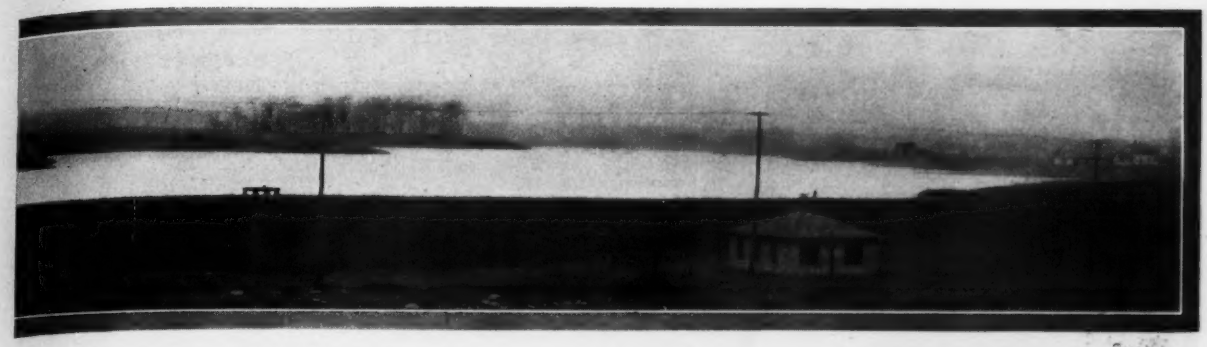
	Gallons
Mango, Ill.	24,000,000
Greendale, Ill.	24,000,000
Bluford, Ill.	90,000,000
Groat, Ill.	48,000,000
Ferber, Ill.	24,000,000
Saline, Ill.	30,000,000
Reevesville, Ill.	48,000,000
Lowes, Ky.	48,000,000

The development of these supplies within reasonable cost presented problems proportionate with those encountered in the construction of the line itself, as the physical characteristics of the territory traversed were such that few natural water supplies were available except on the extreme south end. Numerous streams cross the line at various points, but



A striking feature of the water service development on the Edgewood line is the high degree of standardization attained. At six of the water stations indicated on the adjoining map, the pumping equipment, as well as the pump houses, shown at the left, were of uniform design





The reservoir at Bluford covers 100 acres. The spillway, seen on the opposite page, connects with a concrete flume that leads well beyond the toe of the earth dam

Water Stations "Out of Face"

Illinois Central provides eight new plants with a total annual capacity of 336 million gallons for 169-mile Edgewood line

none of them is entirely satisfactory as a water supply, and with one or two exceptions, they are dry for periods of from three to five months of the year, many of them being rendered unfit for use, particularly during periods of low water, by the mine wastes which are discharged into them.

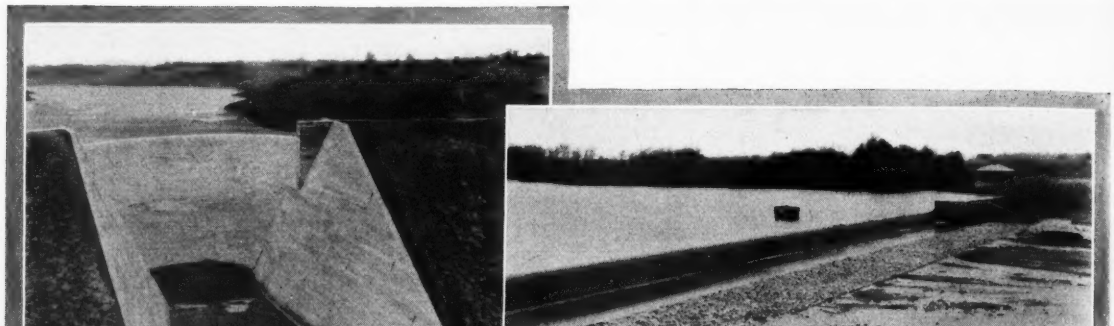
Ground Waters Unsatisfactory

The greater part of the territory through which the line passes in Illinois is underlaid by coal measures, comprising deposits consisting largely of shale with alternating limestones and sandstones and seams of coal. Probably 80 per cent of the entire formation is composed of impervious shaley material yielding limited quantities of water. The limestones are mostly very compact and impervious to water and such water as may be obtained comes from the sandstones. The sandstones are associated with carbonaceous materials containing various mineral salts that make the water objectionable for boiler purposes, and it was impossible to secure subsurface water, either adequate in quantity or of satisfactory quality, north of Reevesville. As an example of the character of the ground waters, the wells at the Bluford shops yield water having the following analysis:

	Grains per Gallon
Iron, alumina and silica oxides	.04
Calcium carbonate	25.10
Magnesium carbonate	3.43
Magnesium sulphate	19.10
Alkali chloride	2.05
Alkali sulphate	5.60
Total solids	55.32

In the absence of suitable ground water or natural surface supplies there was no alternative but to construct impounding reservoirs. Fortunately, much of the country offered suitable locations for the construction of reservoirs by simply damming up valleys. Therefore, the problem of providing water between Edgewood and Ferber narrowed down to the selection of sites for reservoirs suitably located and with ample water sheds to provide sufficient runoff

The pump houses on the Edgewood line conform to a design that has been widely used on the Illinois Central, a square brick building on a concrete foundation



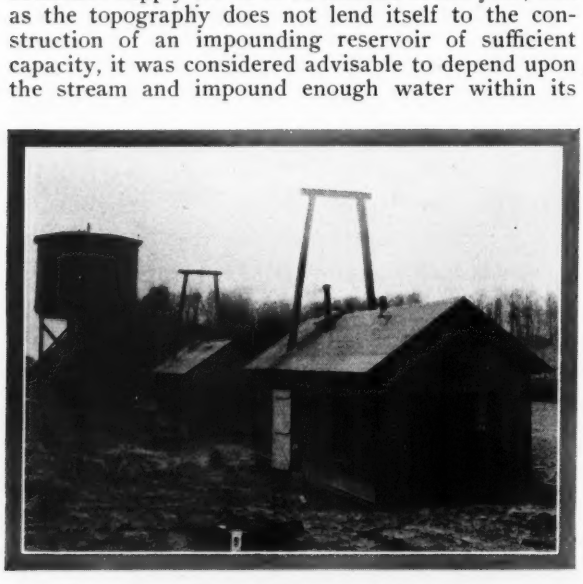
Above—The spillway for the reservoir at Greendale. At the left—The horseshoe spillway in the dam at Mango, constructed to provide the required length of crest in a location affording but limited space

to keep them supplied with water. There are eight water stations on the 169 miles of line, five of which are supplied from impounding reservoirs, two from deep wells, and one from a stream which crosses the line at Saline, Ill.

Locating the Water Stations

The location of the shops and terminal at Bluford made a water station necessary at that point, and as the first water north of Bluford on the main line was at Effingham, a distance of 56 miles, it was decided to construct two intermediate water stations between these points. Suitable locations for reservoirs were found at Mile 218 near Mango and at Mile 233 near Greendale. At Groat, 27 miles south of Bluford, where connection is made with the St. Louis division proper, a fourth water station was established for both through trains and switch engines serving the mines in this vicinity. The station at Ferber is also supplied from a reservoir.

The station at Saline is supplied from Saline creek which crosses the line at Mile 303. While the flow of water is very low in the late summer, there is an abundant supply for 10 to 11 months of the year, and as the topography does not lend itself to the construction of an impounding reservoir of sufficient capacity, it was considered advisable to depend upon the stream and impound enough water within its banks to carry over the extreme periods of drought which occur at irregular intervals every two or three years.



Frame Pump Houses Were Provided at Lowes

Conditions at Reevesville were such that it was thought advisable to make test borings in an effort to develop a supply of water from wells. The first holes in the vicinity of the station were dry, but at a point about a mile south heavy gravel deposits were found which contained an abundance of good water near the surface. Reevesville is located at the junction of the Carbondale district and the Golconda branch, and the construction of a water station at this point made it possible to abandon water stations at Golconda and at Grantsburg on the Carbondale district.

Characteristics of the Reservoirs

While five of the water stations are supplied from reservoirs, only four of them were constructed by the railroad, as it was found at one point that water could be secured from an existing reservoir owned by the United States Fuel Company, by constructing 12,000 ft. of pipe line. This reservoir was constructed about fifteen years ago to supply water to the coal mines in the vicinity of Benton, Ill., and has a capacity of 1,000,000,000 gal. Water is furnished the railroad under a joint agreement with the United States Fuel Company and the Central Illinois Public Service Company which operates the pumping plant connected with the reservoir.

The Mango reservoir has an area of 33.8 acres covered by water, with a storage capacity of 109,000,000 gal. The watershed is somewhat limited, being only 840 acres in extent with a total annual runoff of 125,880,000 gal. This is considered ample, however, as it is estimated that the annual consumption at this station will never exceed 40,000,000 gal. The reservoir was constructed with an earth dam, faced with concrete paving to prevent erosion and wave wash. On account of limited space, a rather unique design was devised for the spillway as shown in one of the illustrations, the spillway being constructed in the form of a horseshoe having a length of crest sufficient to take care of all excess runoff.

The Greendale reservoir has a capacity of 82,000,000 gal. when full, and covers 71.6 acres. The drainage area of 4,740 acres has an annual runoff of 655,000,000 gal. The reservoir is formed by the con-

struction of an earth and concrete dam across a rather flat, narrow valley, the concrete portion of the dam forming the spillway.

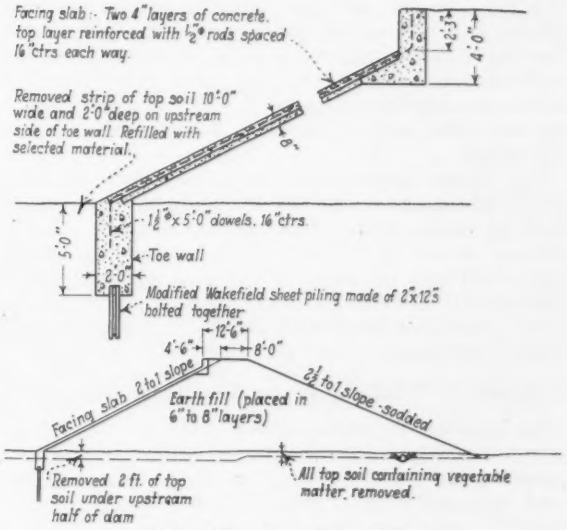
The Bluford reservoir is the largest of the four constructed, covering 100 acres and having a capacity of 209,000,000 gal. The drainage area is 2,029 acres and the total runoff is 274,400,000 gal. per year. The reservoir was constructed by building an earth dam across a valley formed by Four Mile creek, a tributary of Big Muddy river, which is a stream that flows about eight months of the year. The dam is faced with concrete paving on the upstream side to prevent wave wash. The spillway located at one end of the dam is of concrete and includes a concrete box or flume carrying the waste water well below the toe of the slope to avoid wash. The Ferber reservoir has a capacity of 107,000,000 gal. and covers 53.2 acres when full. The watershed has an area of 1,360 acres and the annual runoff is 175,000,000 gal.

Supplies Were Carefully Studied

Extensive surveys and investigations were made prior to the selection of sites and the preparation of plans for the construction of reservoirs. After establishing the drainage area tributary to the sites of proposed reservoirs, the available runoff was determined from rainfall records prepared for years of minimum rainfall. A study of rainfall records over a period of 25 years indicated that the minimum annual rainfall ranged from 22 in. at Carbondale in 1901 to 25 in. at Effingham in 1914; the records of the Carbondale station were used for the Bluford and the Ferber reservoirs, and the Effingham records for the reservoirs at Mango and Greendale.

A table was prepared for each reservoir, showing by months for the years of minimum rainfall, the rainfall runoff over the drainage area, the estimated loss from evaporation and absorption, and the estimated maximum consumption. By means of this table it was possible to estimate the amount of water available for storage each month, the amount in storage and the amount wasted over the spillway. The total amount of land purchased for reservoirs is 690 acres, the total area covered by water with reservoirs full is 258 acres, and the combined area of the watersheds for all reservoirs is nearly 9,000 acres.

All dams are constructed of earth with the exception of that for the Greendale reservoir, where 350 ft. of the dam, which has a total length of 605 ft., forms the spillway, and is


Facing slab:- Two 4" layers of concrete, top layer reinforced with ½" rods spaced 16" ctrs each way.
Removed strip of top soil 10'-0" wide and 2'-0" deep on upstream side of toe wall. Refilled with selected material.
1½" x 5'-0" dowels, 16" ctrs.
Toe wall
Modified Wakefield sheet piling made of 2"x12" bolted together
12'-6"
4'-6"
8'-0"
2½ to 1 slope - sodded
2 to 1 slope
Facing slab
Earth fill (placed in 6" to 8" layers)
Removed 2 ft. of top soil under upstream half of dam
All top soil containing vegetable matter removed.

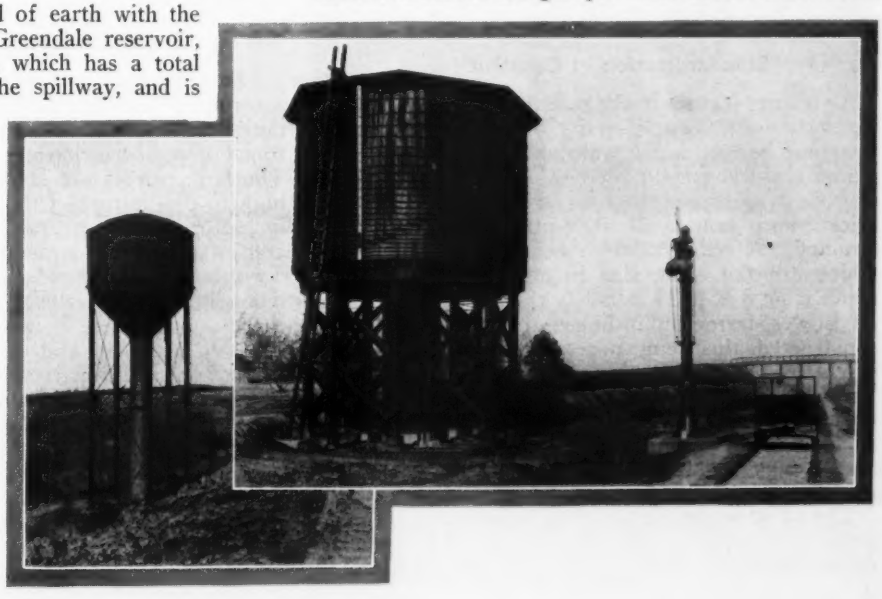
Typical Details of the Dams

constructed of concrete. All dams are faced on the upstream side with concrete paving as a protection against wave wash, and the downstream side is sodded as a protection from erosion. The slope of the dams is 2 to 1 on the upstream side and 2½ to 1 on the downstream side, with a width of 12 ft. 6 in. on top. The dimensions and quantities of earth and concrete in the various dams are as follows:

	Height of dam	Length of concrete spillway	Length of earth dam	Earth in dam cu. yd.	Mass concrete cu. yd.	Facing slab sq. yd.
Mango	30 ft.	88 ft.	523 ft.	38,300	3,042	2,881
Greendale	10 ft.	350 ft.	255 ft.	6,324	2,623	400
Bluford	22 ft.	100 ft.	698 ft.	22,908	1,485	2,008
Ferber	19 ft.	91 ft.	654 ft.	22,311	1,248	2,435

Well Supplies at Two Stations

The water stations at Reevesville, Ill., and Lowes, Ky., are supplied from wells. The two wells at Reevesville are 10 in. in diameter and 92 ft. in depth and are cased with 10 in. (inside diameter) genuine wrought iron pipe. The strainers are 10-in. tubular brass with 0.06-in. openings and are 20 ft. in length. The water rises to within 8 ft. of the surface and each well tested 390 gal. per min. with a draw down



Two types of water tanks were employed, both of 100,000 gal. capacity. The adjoining views show the standard creosoted wooden tank and water column and the conical bottom steel tank on a 45-ft. tower erected at Greendale

of 6 ft. The two wells are pumped with centrifugal pumps at a rate of 500 gal. per min. for both wells. Owing to the possibility that the water level in the wells may be lowered, the pump pits were depressed about four feet below the surface of the ground, leaving the static head of the wells about four feet below the pumps.

The Lowes water station is supplied by two wells 10 in. in diameter and 190 ft. in depth. The water rises to within 40 ft. of the surface and the head is lowered about 20 ft. when they are pumped at the rate of 200 gal. per min. They are cased with 10-in. full-weight, genuine wrought iron pipe and have 10-in. tubular brass strainers 30 ft. in length with 0.03-in. openings.

Separate Drinking Water Supply at Bluford

In addition to the reservoir and pumping plant, which furnish water for locomotives and general purposes at Bluford, two 8-in. wells, 125 ft. deep, each equipped with electric-driven, deep-well pumps, furnish water for drinking and domestic use. This water is stored in a 10,000-gal. elevated steel tank and is supplied through separate distribution lines. The capacity of the wells is very limited and the water is highly mineralized, as may be seen from the foregoing analysis. The yield is 50 gal. per min. from each well and, as a rule, it is necessary to pump from only one well at a time as the consumption of the well water is limited.

As previously stated, the streams crossed by the railroad are not reliable as a year-round supply and are subject to pollution from mine wastes, making it necessary to construct reservoirs at all stations north of Reevesville with the exception of Saline. The proper spacing of water stations made it necessary to locate a tank in this vicinity, and as wells could not be secured and the topography was not suitable for the construction of a reservoir, it was decided to depend for a supply upon the waters of Saline creek, which crosses the right-of-way at this point. While the creek is not subject to annual droughts, as are other streams in this territory, it is subject to drought about one year in three. The banks of the stream are high and it was thought that sufficient water could be impounded by the construction of temporary earth dams in the bed of the stream to carry through extreme dry periods.

Standardization in Construction

A striking feature in the construction of the pumping stations is the uniformity of design followed in the pump houses, water tanks, oil engines, centrifugal pumps and water columns. At six of the seven water stations where pump houses are required, standard brick pump houses 27 ft. square have been constructed, the only variation being in the pump pits which are the same size in all cases but vary in depth from 8 ft. to 14 ft. below the engine-room floor. At Lowes, frame pump houses 16 ft. by 36 ft. were constructed, this being necessary on account of belt drives from the oil engines to the deep-well pumps. Ten of the eleven tanks used for roadside storage are standard 100,000-gal. creosoted wooden tanks on 20 ft. towers, the exception being at Greendale where a steel tank was necessary on account of the height of the tower.

The 14 oil engines used at the seven stations where water is pumped by the railroad are 25 hp. and are exact duplicates with every part interchangeable. The 14 centrifugal pumps are also identical except for a slight variation in the diameter of the impellers due to variation in pumping heads. The water columns, 12 in number, are standard 12-in. with telescopic spouts. All pumping units are of sufficient capacity to permit of pumping all water required in one eight-hour shift, thus reducing the attendance to the minimum. Duplicate pumping units avoid the possibility of interruption to service, facilitate repairs and reduce the cost of maintenance.

The engines are all of the semi-Diesel type. These engines are provided with air starters, the air being supplied by a small gasoline-driven air compressor. Each station is provided with a 10,000-gal. oil storage tank and oil is unloaded direct from tank cars.

The pumps are four-inch, horizontal, split-case, bronze-fitted centrifugal pumps and have a capacity of 500 gal. per min. They operate at a speed of 1,400 r.p.m. and are belt-driven from a friction-clutch pulley on the engine. The pumps are located in pits from 8 to 14 ft. deep, the angle of the belt drive ranging from 30 to 40 deg. The belts are of 6-in., 3-ply waterproof leather.

Use High Grade Pipe

All suction lines and piping within the pump houses are genuine wrought iron pipe and all fittings for wrought iron pipe larger than two-inch are flanged. All underground pipe, including discharge and water-column lines, is Class B cast iron pipe with hub and spigot joints. The sizes and lengths of cast iron pipe used for locomotive supply at the various stations are as follows:

	Discharge Lines		Water Column Lines	
	Size	Length	Size	Length
Mango	8 in.	600 ft.	12 in.	120 ft.
Greendale	8 in.	1,400 ft.	12 in.	180 ft.
Bluford	10 in.	4,000 ft.	12 in.	1,000 ft.
Groat	8 in.	16,000 ft.	12 in.	450 ft.
Ferber	8 in.	150 ft.	12 in.	100 ft.
Saline	8 in.	420 ft.	12 in.	96 ft.
Reesville	8 in.	4,000 ft.	12 in.	190 ft.

There is also several thousand feet of service pipe serving the various facilities at the Bluford engine terminal, including a 50-ton ice plant for manufacturing ice to be used in icing cars. Bluford is also provided with a complete fire protection system of fire mains and hydrants.

Build Creosoted Wooden Tanks

The creosoted wooden tanks are constructed in accordance with the A.R.E.A. standards for wooden tanks and are 30 ft. in diameter with 20-ft. staves and round iron hoops, having a capacity of 100,000 gal. The tank towers are standard 12-post towers 20 ft. high to the bottom of the tank, the entire structure, including frost box and roof, being constructed of creosoted timber completely framed before treatment. Two tanks are provided at Bluford and at Groat, one being located at each end of the yard at each of these points where it is necessary to provide water for both main-line and yard engines. The construction of an additional tank was not only more economical than a long water-column line of large pipe, but it also provides additional storage.

Because the tank at Greendale had to be located at a point where the track is on a high fill, it was necessary to place the tank on a high tower, and for this reason a steel tank and tower were constructed. The tank is of the conical-bottom type and has a capacity of 100,000 gal., on a tower 45 ft. high.

More Prize Awards

SUPPLEMENTING the reports of prize awards following annual track inspections on a number of railways, summarized in previous issues, we give below brief statements of the results of the annual inspections on two other roads, the Delaware & Hudson and the Delaware, Lackawanna & Western.

Lackawanna Makes Track Inspection Awards

The Delaware, Lackawanna & Western has announced the result of its annual track inspection for 1928, held last October, and has rewarded nine foremen with first prizes of $100 each and nine foremen with second prizes of $50 each. In addition, 18 foremen were allowed to retain the rating of "efficiency foreman" which carries with it an additional remuneration of $10 a month throughout the year. This special rating is given to all foremen who have won first prize for three consecutive years, and is then held by the foremen as long as their territories are maintained in first class condition without expenditures exceeding their equated allowances.

In the Lackawanna's practice of making its annual inspection and prize awards, which was described fully in *Railway Engineering and Maintenance* for May, 1928, there is no system prize award, but first and second prizes are given to two foremen on each roadmaster's division. The actual physical inspection of the road is made by other than Lackawanna officers or employees, and no foreman is considered for a prize if his labor expenses for the year have exceeded his equated allowance. As a result of last year's inspection, the highest rating established was 93.83, which was given to F. Cipriani, first prize winner on the Syracuse division. Other first prize winners were P. Lamantino, Morris & Essex, east end, 93.5; J. Mooney, Morris & Essex, west end, 91.0; R. McDonald, main line, southern, 92.67; P. Detorrio, main line, northern, 91.83; D. Pedro, Buffalo, east end, 93.0; E. Schiavi, Buffalo, west end, 92.67; T. Shingler, Bloomsburg, 89.0; and J. Biviano, Utica, 91.17.

The second prize winners on the various divisions were C. Tarantino, Morris & Essex, east end, 92.0; L. Di Santi, Morris & Essex, west end, 90.67; J. McDonald, main line, southern, 92.50; J. Donohue, main line, northern, 91.17; A. Gliserene, Buffalo, east end, 92.83; C. Velocci, Buffalo, west end, 92.17; F. Pignono, Bloomsburg, 88.50; A. Speziale, Syracuse, 92.0; and J. Furnari, Utica, 90.67.

Delaware & Hudson Awards Cash Prizes

As a consequence of a comprehensive annual inspection made on the Delaware & Hudson, that railroad again established ratings covering the tracks of every roadmaster, supervisor and track foreman, and awarded a total of $1,950 in first and second prizes to those foremen showing the greatest proficiency during the year. As has been the rule on that road the final ratings established for each territory were based on two main considerations; the physical condition of the various territories, and the efficiency with which the work for the year was handled.

In carrying out its annual inspection, ratings established by a committee are checked by the records obtained from a special self-contained recording device, known as the Hallade track recorder, which is being used on the D. & H.

When the actual ratings, determined on the basis of physical conditions, have been established, they are adjusted according to the number of man-hours employed on each section during the year, whether above or below the standard number of man-hours which, following the recommended practice of the American Railway Engineering Association, is allotted to each section. On the basis of these adjusted ratings for 1928, the D. & H. awarded 4 system prizes, 2 main line and 2 branch line; 14 division prizes, 8 main line and 6 branch line; and 4 yard prizes. In addition, 8 prizes were awarded to those sections showing the greatest physical improvement during the year.

The grand system main line prize for the year was won by F. Parillo, foreman on Section 14 of the Saratoga division, which track was given a rating of 101.31 per cent, while the second main line prize was awarded to H. McKinty, foreman on Section 2 of the Susquehanna division, with a rating of 100.87 per cent. The first and second branch line prizes were won respectively by V. Santarcangilo, foreman on Section B-1 of the Saratoga division, with a rating of 91.51 per cent, and J. Battisti, foreman of Section 11 of the Champlain division with a rating of 90.26. The division receiving the highest rating for the year was the Champlain division, 88.36 per cent, while the roadmaster's territory receiving the highest rating of 92.58 per cent, was Subdivision L of the Champlain division, of which George Smith is roadmaster.

D. & R. G. W. Uses Scrap Rail to Make Crossing Signs

By Joseph C. Coyle

THE Denver & Rio Grande Western is now making highway crossing signs of the conventional crossbuck type entirely of steel, using material released from other service where practicable. Old 60-lb. rails are used for the posts, two pieces of rail 12 ft. long being riveted together base to base. Pieces of ¼-in. steel plates, reinforced with 1½-in. by 1½-in. angles are

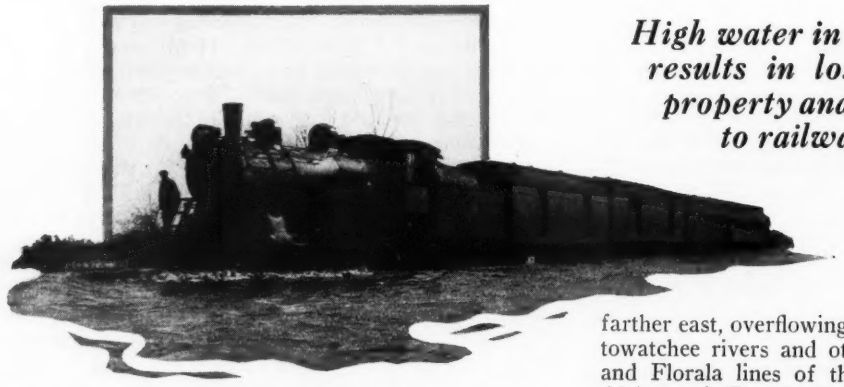
The Signs Are Made In the Railroad Shops

used for the blades. One of the blades has a reinforcing angle in the middle while the other is reinforced by an angle along each edge.

When being fabricated, the rails rest on two long steel horses or skids served by a swinging boom from which a pneumatic drill is suspended for drilling the rivet holes. After all the holes have been drilled, the rails are transferred to another set of horses where they are riveted together and the crossed signs, which had been assembled previously, are applied.

The signs are painted in black letters on a white background and present an excellent appearance. The posts are set in concrete footings.

Spring Rains Cause Washouts



High water in southern states results in loss of life and property and interruption to railway service

HIGH WATER was again a source of hard work and long hours for the track and bridge forces of railroads in widely scattered parts of the country during the latter part of March and early April. A stage of 19.6 ft. in the upper Mississippi river, the highest since 1916, caused the suspension of traffic on the Chicago, Burlington & Quincy between Keokuk, Iowa and Hannibal, Mo., a distance of 58 miles, for several days following March 19, although the track itself was not washed out or seriously affected. After a temporary decrease in the flow early in April, a second rise brought the water level to an even greater height that reached a crest on April 23 and caused a repetition of the experience of March in an intensified form.

Greatest Damage in Alabama

Of a far more serious nature was a flood which occurred in Southern Alabama and Western Florida as a consequence of a three-day downpour that started on March 13, causing a rapid rise of the Alabama, Escambia, Yellow, Pea and Choctowhatchee rivers and their tributaries. As much as eight inches of rain fell in 24 hours, while the total runoff in this area was so great that lowlands were covered with water to a height of three or four feet above previously recorded levels. The area affected embraced a large part of that portion of Alabama lying south of Selma and Montgomery, in which the general direction of the waterways is almost due southward across West Florida to the Gulf. The damage was most severe in the lower reaches of the various streams and the property losses resulting from both overflows and high stream velocities reached several million dollars.

The railroads most serious affected were those having lines that lay in the path of the main flood, namely, the Louisville & Nashville and the Central of Georgia, although the line of the Seaboard Air Line extending southeasterly from Montgomery, across eastern Alabama to Americus, Ga., was also cut, with the result that train operation was suspended for two or three days.

The most serious damage to the Louisville & Nashville occurred between Flomaton, Ala. and Georgiana, a distance of 60 miles on the Cincinnati-New Orleans main line. Train operation in this section was suspended from March 14 to March 22, although through train service was maintained by means of detours. Washouts on this line were the result of a flood in Murder creek, a tributary of the Escambia river, while farther east, overflowing of the Pea, Conecuh and Choctowatchee rivers and other streams, cut the Andalusia and Florala lines of the Central of Georgia and the Alabama & Florida division of the Louisville & Nashville. Some damage was also done to the line of the Louisville & Nashville, extending from Pensacola to River Junction in Western Florida.

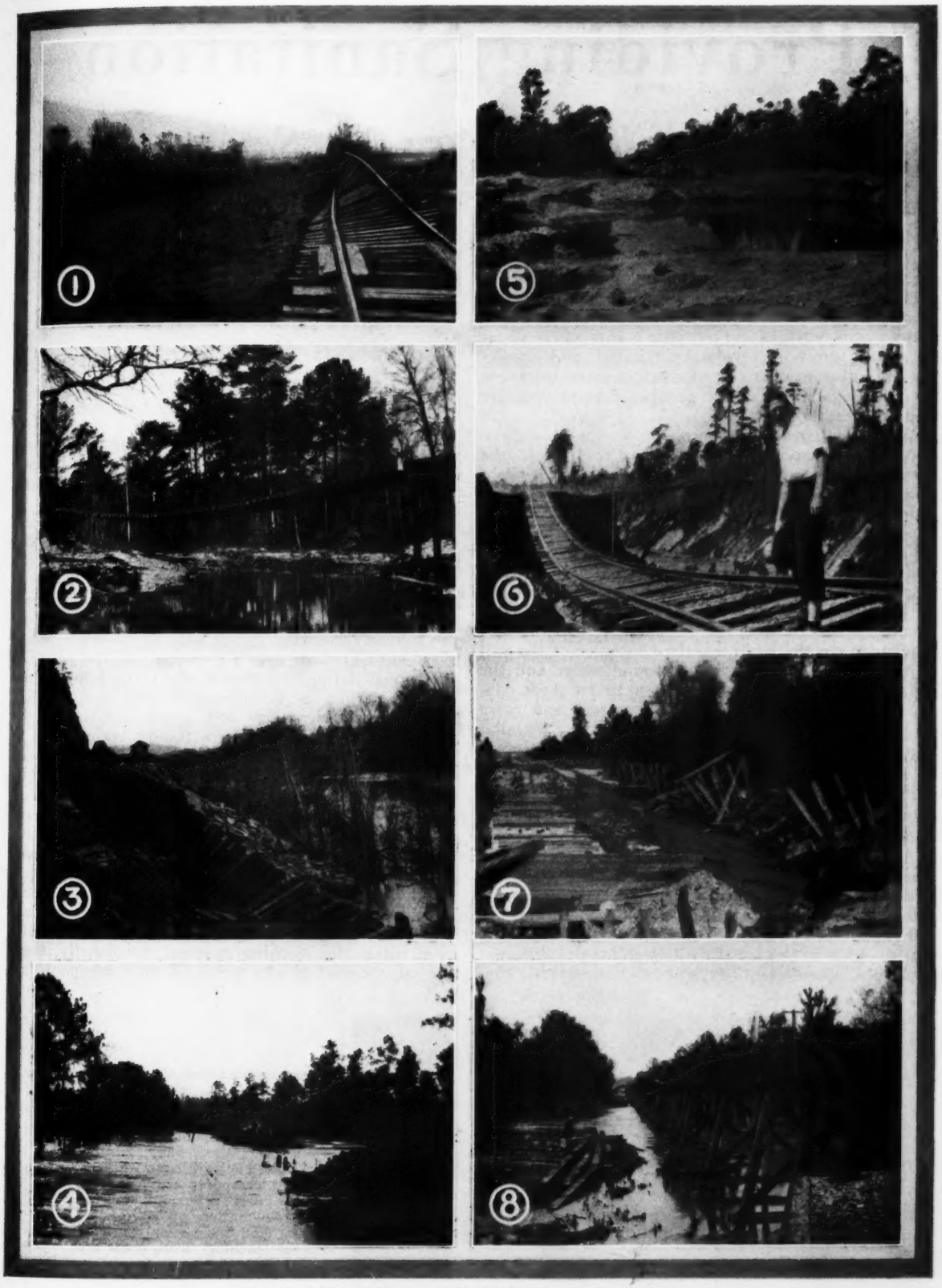
The total damage on the Central of Georgia is estimated at about $200,000, and at one point (High Bluff, Ala.) the permanent solution of the restoration work will involve a change of line costing about $40,000 additional. The point where the greatest single damage occurred was a fill averaging about 25 ft. high just west of the Pea river, on the Florala line. This fill was almost entirely washed away for a distance of approximately 2,500 ft. and numerous holes, from 50 to 100 ft. in diameter, were scoured out to a depth of 10 to 12 ft. below the original ground surface, at the location of the fill. A temporary line was established in the minimum time by using a grading outfit and a locomotive ditcher to rebuild the line on a low level with three-per cent approaches on both ends, and introducing curves to avoid the large water holes. The track will be gradually worked back to line and then raised to grade by steam-shovel work under traffic.

Floods Also in Eastern Kentucky and Tennessee

On March 22 and 23 heavy rains caused floods in southeastern Kentucky and northeastern Tennessee, where, owing to steeper slopes, the runoff was much more rapid and many streams reached flood stage in a few hours' time, with the result that there was considerable loss of life in addition to the enormous damage to property. In this territory also, the loss of the railway property was inconsiderable as compared with the total property damage, although extended interruption to railway service occurred.

The flood at Harriman, Tenn., where 31 persons lost their lives, interrupted the service of the Tennessee Central for three days. A train on the Southern main line between Cincinnati and Chattanooga was marooned between slides at Oakdale, Tenn., and Lancing. Service on the Eastern Kentucky and Cumberland Valley divisions of the Louisville & Nashville was interrupted by washouts in a number of places, but operation on the main lines of these divisions was restored on March 24.

Railway traffic between Montreal, Que., and Toronto, Ont., was seriously interrupted on April 6 and for several days thereafter by heavy rains which caused damage to the tracks of the Canadian Pacific and the Canadian National. A passenger train on the latter road was derailed at a washout near Bowanville, Ont., causing the death of the engineman, although the train was proceeding very slowly at the time of the accident.



Typical Flood Damage in Alabama and Tennessee

(1) "Corkscrewed" track on the Harriman & Northeastern (Southern) near Harriman, Tenn. (2) A fill washout on the Louisville & Nashville main line south of Montgomery, Ala. (3) What was left of a bridge on the same road near Harriman. (4) Flood damage on the Alabama & Florida (L. & N.). Flood views on the Central of Georgia—(5) Holes 10 ft. deep were formed after a 25-ft. fill was washed out. (6) A change of line will be made to avoid this hole. (7) What was left of a trestle at Pea river. (8) The deck of the trestle over the Choctowhatchee river was carried away.

Providing Sanitation

Where There Are No Sewers

Varied experience of the Long Island illustrates successful practices and points to the need for a study of local conditions

THE DEMANDS of society, and frequently of civic regulatory bodies, for the strictest care in the maintenance of public sanitary facilities, creates a considerable problem in many instances for the building and water service forces of the railways. This is true particularly in the disposal of sewage at many towns, villages and outlying points where water or sewers, or both, are not available, and applies not only to passenger stations, but in many instances to railway facilities where groups of employees are housed or stationed.

While this is not a new problem, and while experience in the disposal of sewage has resulted in the formulation of fairly definite principles, it is a problem which repeats itself with practically every installation, and must be solved correctly if a road is to adopt the most effective and economical method, and be assured of facilities which will preclude the expensive and disagreeable work of continual sewage disposal plant maintenance. Some of the more important factors which should be taken into consideration in connection with this problem are the probable demand upon the facilities, the character of the soil in the vicinity, the height of ground water and the most economical system of disposal under these conditions. All of these factors are present and more or less variable in connection with railway installations, and it is desirable, therefore, that railway forces follow approved practice in carrying out work of this character.

Use Five Different Systems of Disposal

A road which has had considerable experience in this work, and an unusual degree of success, is the Long Island, some of whose practices are of special interest. In spite of almost ideal soil conditions for individual sewage-disposal facilities on Long Island, this road has in service at various points five different types of disposal plants designed to meet special conditions. Four of these types of plants depend upon a water supply, while the fifth type, which is used at only two points, depends upon chemical action for sewage purification.

The most common sewage disposal plant in use on this road consists simply of a leaching cesspool with a suitable vitrified tile pipe connection with the toilet facilities. This type of installation has been found sufficient in many instances, particularly where the requirements are not unusually severe, and where the subsoil consists of coarse sand or gravel, a condition which prevails over a large part of the island.

In constructing this type of plant, the Long Island has found that the main consideration is to provide a pool of sufficient size and depth, the size of the pool being increased if there is any anticipation of possible heavy usage at certain periods of the year, or general increased usage in the future. Under practically all conditions, circular pools with inside diameters of from 6 to 8 ft., and 10 ft. deep, have proved sufficient. These pools have been constructed of both standard concrete building blocks and special cesspool blocks, the latter being approximately 15 in. long by 8 in. high, and 4 in. thick. These blocks are made of concrete in curved molds, and are each provided with a number of 1½-in. or 2-in holes to facilitate the leaching process. Ordinarily, these special cesspool blocks are used only for pools six

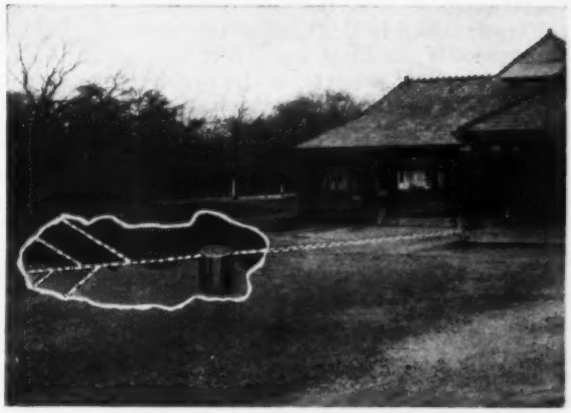
A two-cesspool installation at a rather busy station. Where conditions warrant, two cesspools are provided, the first primarily for the accumulation of solid matter and the second entirely for leaching. Both pools are laid with open joints.

feet or less in diameter. Brick in two courses with open staggered joints was formerly used to some extent on the Long Island in cesspool construction, but this practice has given way to the use of building blocks, mainly because brick construction was deemed to be less effective and more costly.

In constructing a pool with either type of blocks, the bottom, which is left unpaved, is established well below the line of porous subsoil, and at least two feet below this line if possible. The blocks in either case are built up with open joints throughout to facilitate leaching, and the top of the pool is constructed in the form of what is called a "beehive" arch, and provided with a two-foot manhole for cleaning purposes. Ordinarily, the manhole is constructed at the ground level, but where this is liable to result in the pool becoming flooded at times by surface drainage, the top of the pool, or the manhole, is placed slightly below the ground level and covered with earth, or extended slightly above the ground level. The inlet to such a pool is kept as high as possible, care being taken, however, to provide a slope in the soil pipe line of at least ¼ in. to the foot.

System of Two Cesspools Increases Capacity

Cesspools have been built and operated successfully on the Long Island, even though the bottom extends well below the ground water line. The main consideration in such cases has been found to be that of keeping the inlet as far above the water line as is possible in order to prevent the backing up of water into the soil line during the periods of peak demand. Cleaning of cesspools, no matter how constructed, has been found necessary at intervals owing to the accumulation of solid matter and the gradual slowing up of leaching because of the saturation of the surrounding soil with greases and waste. However, it is felt on the Long Island, that the frequency of cleaning can be reduced greatly, and that much



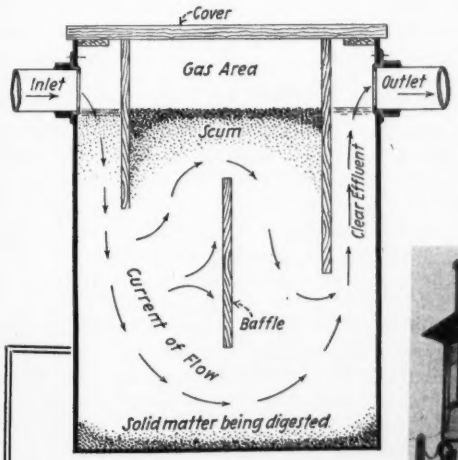
A Septic-Tank, Field-Tile Installation Where the Ground Water Level is High

can be saved in maintenance expense by proper initial construction, since the cost of maintenance is generally high, particularly where scraping of the walls of the pool becomes necessary.

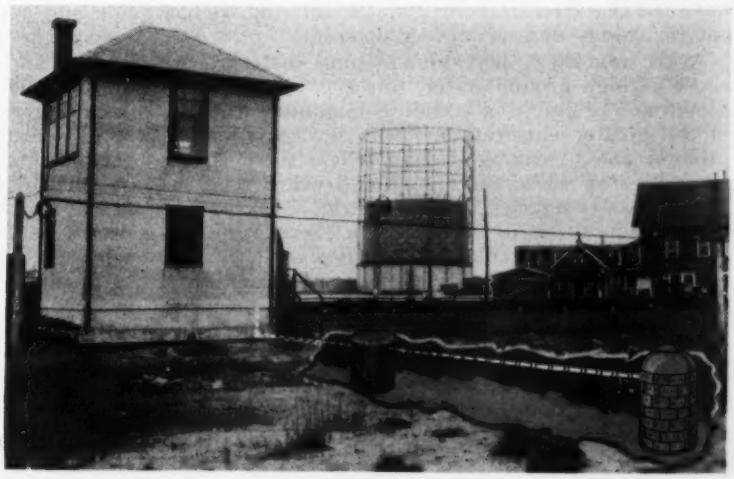
Where conditions warrant on the Long Island, two such cesspools have been used in conjunction with each other, the first primarily for the accumulation of solid matter, and the second for leaching purpose entirely. In this type of construction, both pools are usually laid with open joints, but the second pool is not ordinarily provided with a man hole. This type of layout has not only been used by the Long Island in new construction, but also in obtaining further service from old single-cesspool installations, the leaching qualities of which have been lost. In these latter cases, the new leaching pool is installed some distance away from the old pool, and is joined to it by a tile pipe line extending from a "goose neck" near the top of the old pool to the top of the new one. Such an arrangement not only provides capacity far in excess of a single leaching pool, but promises also to extend the life of the new leaching pool considerably.

Septic Tank Systems Are Effective

Another of the disposal systems used on the Long Island is the combination septic-tank leaching-cesspool system, this system having been installed with the idea of precluding cesspool cleaning through the



Sketch section through a septic tank showing the action that takes place



A septic tank with a shallow leaching cesspool, shown at the right, serves this signal tower effectively

bacteriological decomposition of the solid matter in the septic tank. In this system, the septic tank, which is practically air tight and which is constructed of either metal or concrete, is the first unit in the soil line. Within this tank, decomposition of the sewage is brought about mainly by the action of anaerobic bacteria which live and thrive in an atmosphere deprived of oxygen. With a tank of proper capacity with respect to the volume of flow and the period of detention, the effluent discharged from it to the leaching pool appears like clear water. It has been found that, under ordinary circumstances, a septic tank should be large enough to retain one day's flow of sewage from the building it serves in order to function properly. This permits a slow and easy current through the tank, allowing proper septic action and the settling of the sludge.

The installation of such a system has been found relatively simple, consisting mainly of a soil line from the toilet facilities to an inlet near the top of the septic tank; the septic tank itself, which can be as near the surface of the ground as is consistent with sufficient pitch or slope in the soil line; and an effluent line extending from near the top of the septic tank to the top of the leaching cesspool. The cesspool in such an installation is constructed in a manner similar to that described previously in connection with other types of systems, and since the pool in this instance is not required to handle solids, it is usually constructed somewhat smaller than the combination solids and leaching cesspool. Such a pool should not require attention of any kind for a considerable number of years.

Filter Bed Disposal of Liquids

This type of installation has been provided even though the bottom of the cesspool extends below the ground-water line, but where the ground water or tide rises to within a few feet of the surface of the ground, it has been found advisable to install a system of field drainage tile to carry off the effluent from the septic tank. The system of field tile in such an installation consists of a main leader pipe line of four-inch inside diameter, with laterals of smaller size pipe extending off to each side, either at right angles, or at lesser angles to produce a fan-shape arrangement. In all cases this leaching field, or filter bed, lies in a bed of porous material such as coarse sand or gravel, which extends throughout the entire area of the filter bed, and at least 12 in. below the tops of the filter pipes. The size of this filter system depends largely upon the character of the material making up the bed and the volume of flow imposed upon it.

Aside from being necessary in some instances because of high ground water, this type of system is sometimes advisable in certain communities because of the greater purification of the sewage which is brought about, making it safer where there is any possibility of contaminating ground water used for drinking water supplies. In this system, supplementing the decomposition of the solids in the septic tank, the liquid from the tank is, to a large extent, purified and made safe to put back into the soil by the process of nitrification which takes place in the filter bed.

Chemical Toilets Are Sometimes Necessary

Where water for sanitary purposes is available, the Long Island has found one of the above-mentioned systems of waste disposal satisfactory, but where water is not available it has been confronted with a problem which is somewhat more difficult. Ordinarily, its buildings or stations which do not require running water have small demand for sanitary facilities, and can be taken care of adequately by a well-kept toilet building in the immediate vicinity. Exceptions to this general rule are found, however, where running water is desirable, but where conditions make it impractical or prohibitive. Where these conditions exist, a substitute arrangement has been found in the use of what are called waterless or chemical toilets, which can be secured in several styles and various capacities to suit particular requirements. At the present time, the Long Island has two such toilet installations.

In this particular design of toilet, the bowl is connected to a metal tank suspended below the floor or embedded in the ground, in which is kept a chemical which acts immediately upon the matter reaching the tank, disinfecting it and reducing it to a state in which it is powerless to create a nuisance. Proper agitators are provided to keep the chemical well mixed and to insure complete chemical action, and ventilators are provided to carry gases and offensive odors to a point above the roof.

Methods of Cleaning

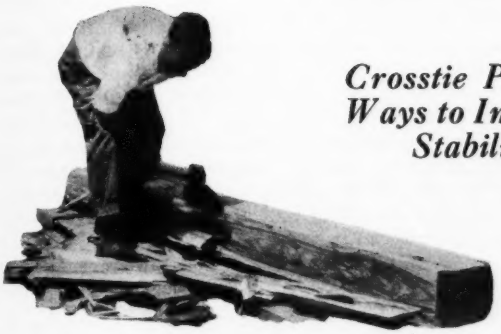
Two methods of clean-out are provided in these tanks; a valve at the bottom through which accumulated matter can be drained off, and a larger opening in the top through which the matter can be pumped out. In either case disposal is not a serious problem, since the use of proper chemicals renders the sewage inoffensive and harmless. Like septic tanks, these waterless toilets can be adapted to meet a wide range of demand, and quite extensive installations of this character are known to exist. One of the special advantages of this system for certain installations is that, unlike water systems, no heating plant is necessary in the building served by the system to keep water pipes from freezing in cold weather. Where water and heat are available, however, one of the approved types of water systems is preferred from the standpoints of both satisfactory service and maintenance expense.

Study Should Be Made for Each Installation

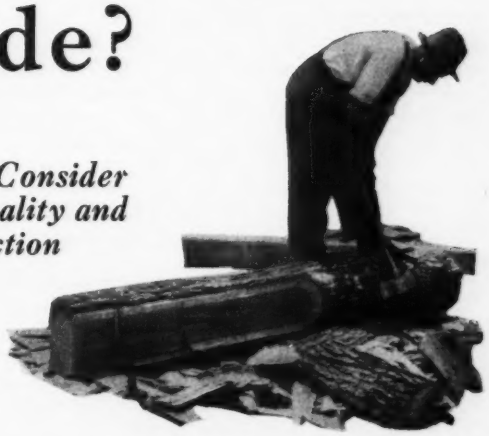
The necessity of maintaining proper sanitary conditions about passenger stations, and also in connection with facilities used by employees, is recognized generally on the Long Island, where, at most points, special regulations require permits for the construction and maintenance of cesspool installation which specify the types of construction permitted, and the location and depth of pools, and prohibit the cleaning of cesspools by other than licensed scavengers. When installing sanitary systems on the Long Island a study is made of all of the conditions involved in each particular case, including these local requirements. When in doubt about the capacity to provide at any point, it is usually the practice to construct for an excess demand, because it has been found that the relatively small additional cost for the larger installation will be more than compensated for through the reduced cost of maintenance. It has also been found advisable to locate the various units of disposal systems, particularly cesspools, where they are readily accessible for repair or cleaning.

We are indebted for the information contained in this article to C. W. Wright, master carpenter of the Long Island.

Can Better Ties Be Made?



Crosstie Producers Consider Ways to Improve Quality and Stabilize Production



DO THE TIES now being produced fall short of the requirements that may reasonably be expected? Is a uniform tie-purchasing policy of advantage to railways and producers? Wherein has the work of the tie committee of the American Railway Engineering Association contributed to the improvement of ties? Can ties be considered a crop? What are the effects of the railway mergers on the tie industry? These topics, which were considered by the National Association of Railroad Tie Producers at its eleventh annual convention at Hot Springs, Ark., on April 23-24, reflect the serious attempt made by this organization to adapt its product more fully to the needs of its customers, the steam railways.

Papers dealing with the first four questions are abstracted below. In addition, Howard H. George, superintendent of way of the Cleveland Railway Company, Cleveland, Ohio, described the crosstie requirements of the electric (street and interurban) railways which normally approximate some three per cent of the total production, while R. C. Johnson of the National Lumber & Creosoting Company described the problems of the field man and Elmer T. Howson, editor of *Railway Engineering and Maintenance*, spoke on mergers and their effect on the tie industry. J. J. Schlafly, Potosi Tie & Lumber Company, St. Louis, Mo., acting president of the Association, presided at all sessions, assisted by Roy M. Edmonds, secretary and treasurer.

Tie Production Is Normal

E. E. Pershall (T. J. Moss Tie Company), chairman of the Committee on Statistical Information, reported that the tie-producing industry was now in better shape than for some time, with stocks reduced to normal and production more nearly comparable with demand. He presented a summarized comparison of production, shipments, stocks on hand and unfilled orders for ties by months for five large companies and urged the cooperation of other producers in making these statistics inclusive of the entire industry. The discussion revealed the favorable attitude of those present toward the idea.

For several years a committee has been endeavoring without success to prepare a specification for ties for use in industrial tracks, comprising primarily those which have been rejected under the standard specifications. This year the committee, of which J. F. Fritschle (Hussey Lumber Products Company) was chairman, recommended that the attempt to prepare this specification be abandoned, which action was approved.

At the closing session on Wednesday afternoon the following officers were elected to serve for the ensuing year: President, F. M. Fonville, George W. Signor Tie Company, Ltd., Shreveport, La.; first vice-president, Roscoe Hobbs, Hobbs Tie & Timber Co., St. Louis, Mo.; second vice-president, F. C. Parrett, Baker Wood Preserving Company, Washington C. H., Ohio; secretary-treasurer, Roy M. Edmonds, St. Louis, Mo. (reelected. Directors: Pacific Coast district: E. H. Meyer, Charles R. McCormick Lumber Company, Portland, Ore.; North Central district: C. A. Weiler, Charles A. Weiler Company, Detroit, Mich.; Northeastern district: Arthur Harmount, the Harmount Tie & Lumber Company, Chillicothe, Ohio; Southeastern district: W. W. Andrews, Nashville Tie Company, Nashville, Tenn.; and South Central district: Thomas T. Poleman, Western Tie & Timber Company, St. Louis, Mo.

District Directors Report on Conditions

A feature of the program of this association is the reports of conditions in the various important tie producing areas, presented by the regional directors.

In the Northeastern district, F. C. Parrett (Baker Wood Preserving Company, Washington Courthouse, Ohio) reported that during the last three months rain and snow have curtailed manufacture to some extent and have made hauling difficult, with the result that there are now few ties at shipping points. He reported further that production in 1928 was far below that of previous years. Practically all treating plants carried large stocks of dry ties over from 1927 with the result that the demand from these plants was very light during the first part of 1928. With competition acute and with treating plant yards heavily over-stocked it naturally followed that prices were slashed to the point where many producers were forced to sell at a loss in order to move their stocks of dry ties. As these stocks are moved prices will advance and production will again be stimulated to normal. During the last few months the demand has increased and prospects are favorable in this area for better business during 1929.

C. D. Christian (Standard Tie and Lumber Company, Meridian, Miss.) reported that in the Southeastern district production and demand during the first three months of 1928 were normal but that during the sum-

mer both production and demand were very light. During the fall, demand increased, which stimulated production although prices were below normal. During the recent spring an abnormal rainfall resulted in curtailment of production, as a result of which there is now a shortage of ties in this district with practically all stocks sold to railways or creosoting plants.

In the North Central district, W. J. Foye (Foye Lumber & Timber Company, Omaha, Neb.) reported that the demand for ties has been considerably below that of 1927 with prices about the same or slightly lower. The winter of 1928-1929 was ideal for heavy production in most of the producing territory and there are now fair stocks at most points of production. The demand is increasing however, and these stocks are gradually being reduced.

J. C. Fritschle (Hussey Lumber Products Company, St. Louis, Mo.) reported that in the South Central district production has dropped to a minimum after a long period of unsatisfactory prices supplemented by a severe winter. The demand in this area has been slightly less than normal during the last year although still somewhat greater than production and as a result the current supply of crossties in stock is less than it has been for several years. Demand has increased recently and conditions are now somewhat improved from the standpoint of the tie producer, although it will take some time to stabilize production after the marked decline of recent years.

Selective Cutting in Tie Operations

The thought that timber is a crop that should be harvested regularly was advanced in a paper prepared by R. D. Garver, forester, Forest Products Laboratory, Madison, Wis., and read in his absence by F. C. Stone, executive assistant, Washita National Forest. In this paper Mr. Garver stated that if timber land is to justify cropping it must be kept productive continuously. Selective cutting, or selective logging as it is sometimes called, does this by taking out the larger trees and leaving the smaller thrifty trees standing to grow into a future cut, thus keeping the ground covered with a well-stocked growing crop at all times. In mixed stands this method of cutting also makes it possible to favor the most desirable species by cutting them lightly and to discriminate against the poorer species by cutting them heavily, thus improving the stand.

During the past summer the Forest Service carried on a logging and milling study on a large tie operation in the Appalachian mountains in a stand of mixed hardwoods which was being managed under a selective cutting policy. The results of this work have not been completely analyzed, but a few figures are available for consideration.

The Appalachian study showed that the felling and bucking cost per thousand board feet for white oak was three times greater for trees 12 in. in diameter than for trees 36 in. in diameter, and twice as great as for trees 18 in. in diameter. The sawing of logs 8 in. in diameter into ties and lumber, when based on 1929 production costs, was 2.6 times greater than for logs 21 in. in diameter. White oak logs 9 in. in diameter yielded a product, practically all ties, that had a sale value of $16.21 per thousand board feet, whereas the ties and side lumber from logs 21 in. in diameter were worth $30 per thousand board feet.

In the eastern part of the United States ties are produced for the most part by small portable mills. Logging is done with horses and the cost of permanent improvements is held down to a minimum. Farmers and small timber owners can cut over their holdings at will. In many cases the cost of permanent logging improvements, a deterrent to selective cuttings, can be kept down through the use of auto trucks. In view of these existing practices it would seem that tie operations are well suited to selective cutting.

Advantages of Uniform Purchases

WHILE at first thought the uniform purchasing of ties throughout the year might be considered of interest only to the producer and to the railway purchasing agent, R. S. Belcher, manager of treating plants, Atchison, Topeka & Santa Fe System, pointed out in an address on this subject that a uniform purchasing policy has also reacted favorably on the treating plants, on the distribution of ties by the store department and on the life of the ties by reason of the fact that such a practice tends to uphold the quality and allow sufficient time for thorough seasoning and orderly treating and shipment. He spoke in part as follows:

In a comparatively few years relatively few crossties will be installed untreated, and those will be used in special situations. About 70 per cent of all of the ties purchased in 1927 were treated so that the question of the economy of treating ties appears to have been settled. Since 1885, the Santa Fe has treated at its own plants, or has had treated for its use at commercial plants, a total of 90,000,000 crossties. Ninety-nine per cent of the ties placed in track during 1928 were treated and of some 60,000,000 crossties in track at the present time, we estimate that about 90 per cent are treated ties, the remainder being largely redwood.

Uniform purchase of ties is made possible by the management sanctioning the carrying of sufficient ties on hand at all times to cover estimated requirements for renewals, additions and betterments, and construction for one year. With a stock of ties on hand sufficient for the coming year, it is the practice to purchase the following year's requirements and arrange deliveries so that, as nearly as possible, approximately equal quantities will reach the treating plants each month of the year.

Rush Purchases Avoided

With a year's time in which to obtain the following year's ties, it is not necessary to go into a temporarily rising market but we can wait until the price has again dropped back to normal, whereas, a road that is urgently needing ties, and buying them as needed, naturally has to pay the market price, even though it is temporarily above normal. The greater part of the Santa Fe ties are hewn and these, for the most part, are made by tie hackers who farm. There are some months in the year in which hewn tie production is low because the tie makers are too busy farming to make ties. By purchasing ties to be used a year hence, it is possible to await the time when the farmer-tie maker can again turn his attention to tie making, and it is not necessary to attempt to force production during the lean months.

Purchasing ties at as uniform a rate as possible, throughout the year, enables a road to keep a force of experienced inspectors rather than decreasing the inspection force and then increasing it again, perhaps by the addition of more or less inexperienced men, as may be necessary when "hand to mouth" purchasing is the practice. Inspectors are naturally more content when there is steady employment in sight, and are more efficient than men filling more or less temporary positions.

Quality can be better maintained by both the producer and the purchaser under a uniform purchase program than under a "hand to mouth" method. We find that it is not very difficult, when accepting ties at a fairly uniform rate throughout the year, to correct any flaw that we may find in our inspection without harming the producers or causing an increase in price, whereas such would probably not be the case at times of forced production.

When a stock of ties is maintained for current use, and receipts, in the most part, are considered applicable to work a year hence, purchases can be made and deliveries controlled so that the ties receive proper seasoning before treatment. On the other hand, if the ties are needed for insertion at the time they are purchased or before sufficient time shall have been allowed for seasoning, it is probable that some, at least, will not receive as much seasoning as they should, and a shorter life will be obtained from such ties by reason of the inferior treatment resulting.

In the territory from which the Santa Fe obtains ties, production is heavier in some months than in others, and when production is heavy the acceptance of ties from the producers is not curtailed unless deliveries exceed the capacity of the treating plants to thoroughly air-season and properly treat

them. From a treating plant standpoint, the ideal situation is a uniform flow of ties into the plant each month. While we cannot quite hope for the ideal in this respect for the reason that it is good policy to obtain ties when production conditions are favorable, our purchasing department finds that it is possible to distribute the production of the yearly requirements in such a manner that there is a fairly even flow of ties to the plants, and we do not at any time accept ties beyond the capacity of the plants to treat, to such an exent that the ties are over-seasoned and deteriorate awaiting their turn through the plant.

We have found at our Somerville, Texas, treating plant that we can season the pine, oak and gum ties cut in the late fall and winter months longer without deterioration than ties cut in the spring and summer, and this is a point in favor of fall and winter production, but we also have found that we can thoroughly air season the spring and summer cut ties, without deterioration, although they must be brought out of the woods soon after cutting and shipped in to the treating plant promptly. At our Albuquerque, N. M., and National City, Cal., plants the untreated timber may be held any reasonable length of time before treatment without decay, but even the Douglas fir and Western Yellow pine take better treatment when seasoned just the right length of time. Correct seasoning can best be had when there is a fairly uniform flow of ties into the plant.

Producers' Failures

IN THE inspection of the millions of ties required annually by the Pennsylvania System and produced over a wide area in the East and South, many deficiencies in their manufacture come to light. These were set forth in an address by F. C. Krell, forester, Pennsylvania System in which he stated that the idea still exists in the tie-producing territories that anything that will provide spiking space should pass for a crosstie. To the holders of that impression it is inconceivable that a crosstie can be a forest product of high standard. Fortunately this type of producer is dwindling in number, mainly because the intelligent consumer will not accept his ties and the contractor or jobber cannot therefore find sufficient markets for his low-grade product. Mr. Krell spoke further in part as follows:

The most frequent difficulties are encountered with those producers who have just begun to manufacture ties or who engage in that work so intermittently that memories of past experiences become dulled. Their ties generally originate in timber of woodlot character from which the better trees have been removed in selective cuttings and the tie logs from the remaining trees contain defects of various kinds. Ties cut from such logs are frequently defective, the defects being chiefly dimensional discrepancies, decay and poor manufacture.

It is possible to imagine some of the troubles of one who is starting with no previous experience as a tie maker. Such a producer may not understand the specifications or he may never have seen them, but he proceeds to cut his trees and hack them into some semblance of what he supposes should be a crosstie. He may cut ties from trees of the wrong species, and may make almost incredible mistakes in the sizes and shapes of his ties. Such beginners and intermittent producers deliver ties to the shipping points which vary in length from 7½ ft. to 9 ft. and as much as 1 in. to 3 in. from standard widths and thicknesses. Frequently they deliver ties bearing quantities of bark, or, if peeling was attempted, with only the outer bark removed. Stumpshots remain on the ties and limbs are often only partly trimmed. Errors in judgment are often made which are costly to the producer; he may make one enormous tie from a log containing two ties or he may cut two ties from a log only large enough for one and thus produce two ties too small for acceptance. Perhaps he cut his logs in winter and waits until the following autumn to have them sawed into ties, which practice results in decayed sapwood. After the ties are hewed or sawed he may stack them solidly and then berate the inspector for a rigorous rejection of the pile-burned ties disclosed when the stacks are opened. Perhaps his order defines the percentage of the various species or sizes desired by the consumer but he cuts heedlessly and expects the consumer to take into his accounts undesirable numbers of ties for which he has no immediate use.

Constant Vigilance Is Necessary

Even the better informed and more experienced producers allow their practices to deteriorate quickly when the consumer relaxes his vigilance with respect to quality and acceptability of crossties. They are as disinclined as anyone to remove bark, trim ragged ends, turn the ties for inspection, cut back the over-lengths, separate the groups, lengths or sizes, and take precautions to keep ties from contact with the ground while waiting for inspection. They are wise in ways for heckling or wheedling the inspector for a higher sizing of ties that barely meet the dimensions required.

Crossties contractors and jobbers who have definitely organized forces in the tie territory and who produce or buy and collect crossties for ultimate sale to a consumer, know well the foibles and fancies of some of the individual small producers. The jobbers are more remiss than the contractors, probably because they most often gather the odd lots of a wagonload and thus inherit proportionately more trouble. Here again, decay, dimensions and manufacture are the chief shortcomings of ties.

Those well-financed and well-organized tie companies which manufacture large numbers of ties on their own operations and supplement that production by subsidizing other smaller operations and woods operators, generally have in charge of their shipping and concentration yards competent tie men whose duty it is to control sizes and qualities and keep all activities operating smoothly. These companies have the advantage of diversified outlets and contacts with consumers can be made mutually helpful and agreeable. However time-worn arguments do arise and the consumer must resort to the specifications for definitions for defects. The questions usually hinge upon such questions of manufacture as a stretching of the ¼ in. tolerance for thickness or width, too careless hewing with resultant deep scorings, retention of bark not readily removable because of the season of cutting, over-size in all dimensions, the probable weakening effect of knots, shakes, splits or holes, or the inspector is not convinced that the anti-splitting device is sufficient or satisfactory.

A mistake common to all producers and one provocative of much argument is frequently made when a tree is cut which discloses a defect and this defect is ignored in measuring and cutting the tree bole into tie lengths. By allowing for and cutting off such a defect in a felled tree before measuring it for tie lengths the tie can often be saved and a waste of six or seven feet of sound tie or log prevented.

In hewing ties, a careless or inexperienced workman will almost invariably cut the lower side of the tie thinner on the under part of the log. He may hew the log to a thickness of seven inches on top but he then slants his stroke and makes it six inches below. The inspector must size from that thin side and the producer loses.

Ties Should Be Stacked by Sizes

The producer can cause much trouble and expense to a consumer where the ties are destined for shipment to a treating plant. The job is not completed until the ties are loaded into cars and if they are inspected as loaded the errors of production become aggravating to both shipper and inspector. Let us assume that several cars of ties are to be inspected and are piled in a limited space without attempt at segregation for size, length or group. The cars are placed and the producer is present with 8 or 10 men to load the ties as the inspector accepts them. It costs the producer to load and the consumer to inspect. Both wish to work as rapidly as practicable because that is most economical. The ties must be separated in the car by lengths, sizes and groups. In the limited space at some sidings the work of sawing off stump shots, completing the peeling, sorting the sizes and groups and laying the rejects to one side must be accomplished. It cannot be done rapidly in the confined space; it cannot be done efficiently, and at times it can barely be done at all. Experience has shown that a crew capable of loading 1,000 to 1,500 ties in one day may load as few as 250 per day. This is costly and unsatisfactory for all concerned and the best practical solution is to sort before piling at the shipping points.

In frequency of occurrence, the major causes for rejections appear to be decay, dimensions, splits and shakes, knots, manufacture and holes.

Research and experiment have increased our understanding of decay in wood far beyond that possible 25 years ago. Excepting "pipe-rot" in cedar and "peck" in cypress, decay of anv kind is objectionable in a crosstie. Preservative treatment will not, as some still vainly believe, make decayed wood good again. Ties are still placed on end on wet sites to conserve piling space but to an ultimate loss to their owners. Many ties with decayed wood one or more faces would provide sound ties of acceptable sizes if the decayed portions were removed, yet the effort to make them acceptable is neglected and they are rejected.

The standard tolerances for dimensions are not intended to mean that the minimum is always to be desired, yet there are producers who seem to subscribe to that belief for their ties are rarely of full size.

Splits caused by seasoning or badly felled trees will always be potential tie troubles. Shakes are at times more difficult

to detect, but timely attention would save producers' losses if incipient openings in the tie are protected and given less opportunity for destructive development. Anti-splitting devices are easily procurable and if more producers would give more than casual thought to this fact many ties would be saved from waste.

If many producers would appreciate that a crosstie in track serves as a beam and that the spikes must be afforded suitable space for driving into the tie, there would be less rejection for too large or undesirably located knots.

The adzing of ties before use is one of the means developed for furthering their life in track by providing rail-bearing areas in one plane on ties which come within acceptable limits of evenness of surfaces or parallelism of tops and bottom. To use for the manufacture of a tie, a log which will not permit the resulting tie to come within the standards for straightness, to score it unnecessarily deep when hewing it, or to exceed the variance defining acceptable evenness and parallel faces is a waste of time, labor and material for the producer.

Must Meet Customers Needs

Successive experiences do not seem to teach some producers that the average consumer knows what he wants in a crosstie and the need to reduce or maintain a given operating ratio requires that he cannot depart in the least in the quality of the tie he must procure. When his procurement costs enter into the final cost of his ties and his inspector must select as well as inspect ties offered by the producers, those procurement costs soon become excessive.

There are producers who are aware of this fact. They study their markets and they learn the requirements of their customers, and when an inspector arrives to inspect the kind of ties his road requires he is not offered the "run of the woods" and required to spend the major portion of his time sorting through the collection, but his acceptances are not burdened with an initial high unit of procurement cost.

This leads to this suggestion: That the producers can help themselves and help their consumers if they will recommend as general practice the separation of their ties by classes, groups and sizes in such a manner as will isolate those containing standard defects objectionable to the requirements of the consumer, thereby saving him unnecessary procurement expense and themselves the losses for transporting and handling unacceptable material.

In meeting the demands made upon him the producer has had to go farther afield for his timber. Utilization of his trees has brought the problem of the small tie, which in many sections probably is the crux of the situation with the majority of the producers. Intelligent consumers are fully appreciative of this problem of those who supply them with crossties and engineers have become increasingly tolerant and discriminating in the use of the different sizes of ties. Patience and education are needed to bring about a wider appreciation of the merits of the small tie, but in the process the producers also can participate by a more judicious use of their timber. Should every tree in a tract be cut simply because a tie of some size is procurable? Would it not be better for the industry if you were to acquaint yourselves with your available markets and cut ties to meet your conditions? No small part of the existing woeful want in many formerly active tie territories can be attributed to the willful waste of the small and immature trees. Are there not, ordinarily, sufficient small ties in the logs from the upper portion of the tree without adding to the problem of disposition by cutting the small tree? True, where timber only is purchased, and the cutting time grows short, there can be argument for utilizing the small tree, but are habits so controlling that you cannot bargain for only those trees for whose products your markets afford outlets and enable you to dispose of the small sizes of ties which are incident to the production of the larger ones?

Thirty Years Progress in Crosstie Standards

THE TIE committee was one of 14 committees created at the time that the American Railway Engineering Association was organized in 1899. The early reports of this committee and the resulting discussions at the early conventions throw many interesting side lights on the "state of the art" at that time, while the reports that have been presented regularly from year to year depict the development that has occurred in current thought regarding this essential unit of track construction. W. J. Burton, chairman of the Tie committee of the A. R. E. A. and assistant to the chief engineer of the Missouri Pacific reviewed the work of this committee. His address is abstracted below.

The first report, presented at the 1900 convention, and evidently the work of the late Mr. Julius Kruttschmitt, chairman of board of the Southern Pacific, emphasized the need for accurate tie-life data, of which there was then little or none, and submitted proposed forms for voluntary reports from the railroads. These forms summed up the results on the per-mile-of-maintained-track basis not unlike the present statistics, but probably because the forms were quite elaborate, little or no data resulted from this first effort. Methods of dating ties so that their ages, when taken from the track, could be determined were also discussed at this convention. Two or three roads at that time were using cast iron hammers in which the year was indicated by large numerals, with which the ties were dated and mention was made of a so-called "galvanized tack" with the date on its head. Other means included the notching of the ties.

Octave Chanute, in speaking on timber treatment before the convention, estimated that 2½ per cent of the renewals in the United States in 1900 would be made with treated ties and agreed with the prevalent idea that the railroads would soon face a tie famine and there followed a lengthy discussion of metallic ties and of catalpa tree planting. For a number of years afterwards tree planting was a popular diversion among some of the railroads.

Metallic and substitute ties were also favorite subjects for report and discussion during the early years of the association, even though the 1901 report of the Tie committee had stated that "the cost as compared with wooden ties is so great that this does not appear at present to be a live question."

Early Attitude Towards Inspection

We find the statement in the second report that—

"as regards inspection in purchasing, the inspector must be given no latitude as to the interpretation of the specifications, which should be so explicit as to leave no opening for a misunderstanding."

When one considers the variety of the specifications then in use, and the utter impossibility of determining some of their requirements, he can see that the honest producer was in no position to accumulate stocks of ties prior to the receipt of specific orders. However, some producers then, as now, did not always understand that there may be good justification for what may seem an undue tendency on the part of the engineer to split hairs in connection with his application of specification. For instance, we know that one of the more important functions of the crosstie is to serve as a beam and our engineering schools teach us that the beam strength of a rectangular beam varies as the cube of the depth. The engineer has sometimes been considered unreasonable because he insisted that ties of less than full thickness be degraded. Is such criticism justified when we know that a size three tie only ½ in. undersize, as regards thickness, is only about three-fourths as strong as one full size, and that a size three tie an inch thin is only a little over half as strong as a full size tie? The insistence upon full size takes on a different aspect when we understand such facts, because no one would consider paying a dollar for only fifty or seventy-five cents worth of beam strength, any more than he would think of paying full price for a pound of sugar when that pound contained only 9 to 13 ounces.

The committee further reported in 1901 that:

"A uniform set of specifications for present use would be a benefit both to the railroad companies and to the tie makers. As it is now, where different railroads purchase ties in the same territory, it is customary for several inspectors to go over the same lot of ties, each picking out ties which come nearest to his specifications, which leads to a great variety of classes of ties and creates trouble for all concerned."

Decay Was a New Danger

An important feature of this convention was an address by Dr. Hermann Von Schrenk, in which the nature and means of spreading of decay were explained and the succeeding discussion indicated clearly that the ideas of infecting sound timber with spores from decaying timber, and that timber decay was the result of organic growths, were new to practically all present. Although now generally well understood, it is still much too commonly found that what were perfectly sound ties when made, have been subjected to infection and even serious decay through failure to pile them properly in dry locations entirely free from decaying wood. In this respect not only are some producers but also some railroads at fault. Too often the producer is satisfied if the decay caused by bad handling after manufacture has not progressed far enough to prevent the creosote from hiding the decay from the purchaser; and too often the railroad allows ties which were perfectly sound when delivered by the producer on the right of way to become infected and even badly decayed through the false idea of economy that ties can be seasoned just as well in scattered

piles along the right of way as in well-drained, clean tie yards where they can be watched, irons applied, and treated as soon as sufficiently seasoned. It is also too common on some roads to see old ties and other timbers which have been removed, allowed to rot alongside the track, with every opportunity to infect the ties in the track.

The First Specification

The first tie specification prepared by the committee was presented at the 1904 convention. This specification was more like the present specification than some which came afterwards. For instance, there were seven stardard sizes or classes, viz: 7 in. by 10 in., 7 in. by 9 in., 7 in. by 8 in., 8 in. by 9 in., 6 in. by 8 in., 6 in. by 7 in., and 6 in. by 6 in. The permissible woods were classified as between those which might be used untreated and those which, as the specification reads: "shall preferably not be used for tie timber without a preservative treatment."

The manufacture clause of this 1904 specification reads—

"all ties must be well and smoothly hewed or sawed out of straight *growing* timber of specified dimensions and out of wind, sawed ends, with straight and parallel faces, the minimum width of either face to be not less than that given in the table of dimensions. All ties must have the bark entirely removed before being delivered on the company's ground. Except in pole ties with rounded sides, none shall be less than eight inch face, and in no tie shall the thickness be less than six inches. A variation in size will be permitted of one-half inch over in thickness, two inches over in width and one inch over in length."

This specification, while much like the present specification, was presented with a very important difference in understanding as regards its use. Each road was expected to pick out the one particular size which it desired to specify and there seems to have been no idea that the larger roads would accept several or all of the sizes. Most of them would probably have specified the large sizes, leaving the producer with the smaller sizes on his hands. Rather, perhaps, the committee did not appreciate the fact that the smaller sizes must come along with the larger, if reasonable or customary prices were to be maintained, and erroneously assumed that the producer could economically manufacture any size selected.

By vote of this 1904 convention, over the protest of the Tie committee, the requirement that ties must come from growing timber was inserted, disregarding, or not appreciating, the fact that dead timber may be perfectly sound; that timber in growing trees may be unsound; that failure to use sound dead timber would be wasteful; and that the tie producer would usually be unable to tell whether the sound tie came from a tree growing or dead at the time cut. Fortunately for all concerned, present day co-operation between users and producers of ties makes such mistakes impossible.

The 1904 specification appears to have been too far in advance for the industry at that time and there was practically no adoption of it. A few years later we find the Association balloting adversely on the question of a standard size of tie.

In 1909 a very elaborate report on substitute ties was presented and for several years thereafter this subject was given a great deal of attention. The economics of the substitute tie question were not appreciated then as now, nor were the benefits from proper handling and treatment of tie timber in evidence as they are today. One interesting feature in this connection is that tie record forms, gotten out in 1909, provided for treated pine, hemlock, beech and spruce but not for oak, the idea of treating any kind of oak apparently not having been thought of. Treatment seems to have been considered more as a means by which inferior woods could be made usable for crossties than a means for reducing tie consumption and cost.

The Standard Specification

The World War, with the resulting Railroad Administration, presented the opportunity for a really standard tie specification which would not only be drawn up, but which could be put into actual and extended trial and use. The Railroad Administration drafted a forester who had not only had extended experience in the U. S. Forest Service, but who was in charge of the inspection of forest products for the then largest consumer of crossties. This man had, for several years, been associated with the tie men of a group of large, but competitive railroads, who were attempting to standardize both specifications and inspection and in his position as associate manager of the Forest Section in the Division of Purchases and Stores of the United States Railroad Administration, he took advantage of this prior work in putting into effect a specification aimed at reducing the great variety of ties then being ordered to the shapes and sizes really required and actually obtainable. This specification was thus based on a knowledge of forest growth and management and timber physics as well as upon experience in purchase.

However, this United States Railroad Administration specification was a radical departure from past practice, and probably partly because of the well known inertia to any change, it did not meet with the favor of many if not the majority of buyers and shippers. Moreover, this disfavor was heightened because the specification itself could not be judged on its own merits independently of certain objectionable purchasing practices of the Railroad Administration. While the United States Railroad Administration was by no means perfect, the great advantages to all concerned of a uniform specification were demonstrated.

The experience with this specification was watched closely by the Tie committee so that, following the return of the roads to their owners, the committee was able to take advantage of this experience and formulate what has since become the standard specification.

It would be idle for me to try to tell you whether the standard specification has benefitted the producers, although I am sure what the almost universal verdict would be. But speaking for the railroads, and basing my opinion not only upon personal and committee inspections but also upon the almost unanimous reports and maintenance men, the ties received in the last five or six years are on the average much better than those obtained prior to the adoption of the standard. I do not mean to imply that all of the improvement is due to the specification. No doubt much of it has come about through the better understanding between producers and consumers. But whatever the cause or causes, the fact is that the great majority of crossties fully meet the specification, and are not only carrying heavier loads and more of them than ever before, but are doing so with greater economy, meaning, by the latter, economy as measured in cost per year of life rather than in first cost per tie.

Furthermore, we hear little of a tie famine today. The greatly increased average life secured because of the greater care in production and use, and because of preservative treatment, together with the movements for reforestation and for the consideration and use of timber as a crop instead of as an exhaustible resource, have made it practically certain that the tie industry need not look forward to the day when railroads must choose between steel or concrete ties.

The great majority of users specify ties today according to the standard specifications, but there are isolated buyers who still insist on non-standard ties. The continued stabilization of the tie industry would seem to depend upon the maintenance of established standards of quality and size. You gentlemen of the tie industry owe it to your business to resist, by all proper means, any demands or requests for substitution, or any efforts to mislead those responsible for railroad finances through the misbranding or overgrading of ties. Calling a size two tie a size three does not add one day's service to that tie or add one cent to its true value. It cannot give more than a temporary benefit, if any, to the individual demanding it and any such benefit in the long run is at the expense of the company.

Producers' Grade Marking Proposed

The manufacturers of soft wood lumber are now marketing their products with the guaranteed grade stamped on each piece. It is my opinion that the adoption of such a practice by all the members of the National Association of Railroad Tie Producers, with each tie bearing the manufacturer's name and the guaranteed size and quality, would be the most beneficial step the industry could take. The few undesirable black sheep would soon find it impossible to continue in business without adopting the standards and practices of the Association and the industry would be secure in its place among the sound, stabilized and modernly managed ones.

Of course the objection will be made that a market must be found for the undersize and unsound ties. While in my opinion much of the undersize results from carelessness in manufacture, the setting of the saws a bit too close in the belief that the inspector will not catch the deficiency, or the cutting of trees too small or unsound, and the unsoundness from improper handling after cutting, there is legitimately to be expected a certain small part of the product which is distinctly second quality. Such material should be labelled and sold as such and the finding of a market for it depends on the relative prices of the product as a whole. In this feature also the Association is in a position to benefit the industry greatly by pointing out when it is true economy to use seconds or rejects, rather than permitting roads to go along with strictly specification ties, or by endeavoring to avoid selling the better ties when seconds will be equally satisfactory and less costly for the particular service.

Why should not the producer mark rejects or seconds as such before the railroad inspector gets to the pile and thus discontinue putting the whole burden on the inspector? Such action would be in line with modern business ethics. Better still, let the producer guarantee size and grade and mark them on all ties, leaving the railroad inspectors to check, the same as is done with practically all other materials purchased by a railroad.

Rail Production Was Less in 1928

THE production of steel rails in the United States during 1928 totaled 2,647,493 gross tons or 158,993 tons less than the output of 2,806,486 tons in 1927; it was 570,156 tons less than in 1926, the year of greatest production since 1913. The above statements, as well as those which follow, are taken from statistics issued by the American Iron and Steel Institute, no distinction being made in the tables between T-rails of standard patterns rolled for use on steam railways and the girder or high T-rails produced for use by electric and street railways. For recent years, the tonnage of such rails was as follows: 1922, 128,878 gross tons; 1923, 130,056; 1924, 85,553; 1925, 98,620; 1926, 116,374; 1927, 99,621; and 1928, 113,150 gross tons.

Production of Rails by Processes, Gross Tons, 1913-1928

Years	Open-hearth	Bessemer	Rerolled*	Electric	Total
1913	2,527,710	817,591	155,043	2,436	3,502,780
1914	1,525,851	323,897	95,169	178	1,945,095
1915	1,775,168	326,952	102,083	.....	2,204,203
1916	2,269,600	440,092	144,826	.....	2,854,518
1917	2,292,197	533,325	118,639	.....	2,944,161
1918	1,945,443	494,193	101,256	.....	2,540,892
1919	1,893,250	214,121	96,422	50	2,203,843
1920	2,334,222	142,899	126,698	297	2,604,116
1921	2,027,215	55,559	96,039	5	2,178,818
1922	2,033,000	22,317	116,459	.....	2,171,776
1923	2,738,779	25,877	139,742	118	2,904,516
1924	2,307,533	16,069	109,730	.....	2,433,332
1925	2,691,823	9,687	83,747	.....	2,785,257
1926	3,107,992	12,533	97,124	.....	3,127,649
1927	2,717,865	1,566	87,055	.....	2,806,486
1928	2,580,141	2,718	64,196	438	2,647,493

*Rerolled from old steel rails.

The production of rails weighing 100 lb. per yard or more in 1928 was 1,922,177 tons or 9,771 tons less than in 1927 and 44,263 tons less than in 1926. However, the production of rails weighing 120 lb. or over increased from 617,524 tons in 1927 to 718,428 tons in 1928, or 100,904 tons. While the production of rails weighing 100 lb. per yard or more was less during 1928 than in the previous two years, it is significant that the tonnage of this classification of rail in 1928 represented a larger proportion of the total than in any previous year, amounting to 72.6 per cent in 1928 as compared with 68.8 in 1927, 61.1 in 1926 and 39 per cent in 1921, indicating a steady trend toward heavier rails.

The production of alloy steel rails in the United States during 1928 amounted to 6,453 tons, a considerable increase over the production in 1927, which amounted to 1,265 tons. Titanium rails in 1928 totaled 3,711 tons and manganese rails (10 per cent and over in manganese) totaled 2,713 tons. The statistics do not show the production of intermediate manganese steel rails as a separate classification.

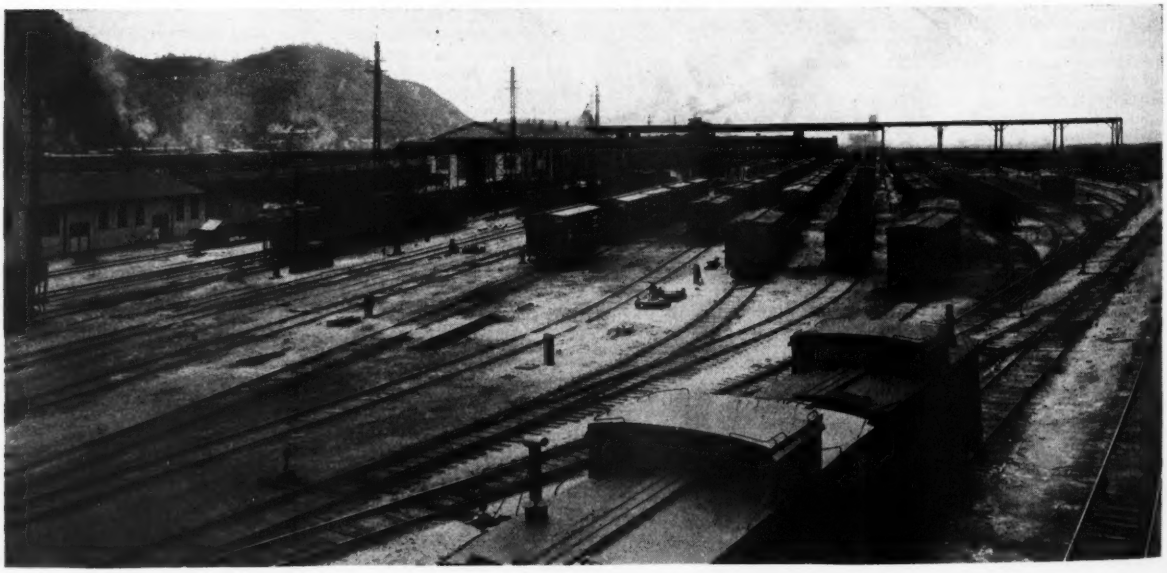
Rails produced by the electric process totaled 438 tons, and this amount, while small, was only 32 tons less than the total amount produced from 1915 to 1927.

Production of Rails by Weight per Yard, 1915-1928

Years	Under 50 pounds	50 and less than 85	85 and less than 100	100 and less than 120	120 pounds and over	Total gross tons
1915	254,101	518,291	742,816	688,995		2,204,203
1916	295,535	566,791	1,225,341	766,851		2,854,518
1917	308,258	882,673	989,704	763,526		2,944,161
1918	395,124	665,165	888,141	592,462		2,540,892
1919	263,803	495,577	965,571	478,892		2,203,843
1920	489,043	433,333	952,622	729,118		2,604,116
1921	211,568	214,936	902,748	849,566		2,178,818
1922	265,541	274,731	728,604	902,900		2,171,776
1923	272,794	300,907	864,965	1,465,850		2,904,516
1924	191,046	213,274	853,431	1,175,581		2,433,332
1925	163,607	219,648	765,371	1,636,631		2,785,257
1926	197,260	256,287	797,662	1,966,440		3,217,649
1927	161,836	173,257	539,445	1,314,424	617,524	2,806,486
1928	134,197	125,726	465,393	1,203,749	718,428	2,647,493

Production of Alloy-Treated Steel Rails, 1919-1928

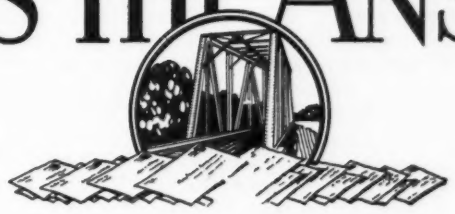
		Production by alloys		Production by processes		Production by weight per yard				
Years	Total production. Gross tons	Titanium	Other alloys	Open hearth and elect.	Bessemer	Under 50 lbs.	50 and under 85 lbs.	85 and under 100 lbs.	100 and under 120 lbs.	120 lbs. and over
1919	6,476	6,207	269	6,476	.....	.....	.....	3,920	2,556	
1920	12,909	11,652	1,257	12,909	.....	.....	514	5,069	7,326	
1921	6,276	2,804	3,472	6,276	.....	.....	71	4,277	1,928	
1922	3,163	2,493	670	3,163	.....	.....	321	835	2,007	
1923	2,142	346	1,796	2,142	.....	.....	56	317	1,769	
1924	5,167	1,696	3,471	5,167	.....	.....	.....	847	4,320	
1925	4,009	1,616	2,393	4,009	.....	70	47	.....	3,892	
1926	4,216	1,099	3,117	4,216	.....	.....	42	1,027	3,147	
1927	1,265	.....	1,265	1,265	.....	.....	.....	374	391	500
1928	6,453	3,711	2,742	6,453	.....	29	.....	879	1,652	3,893



Car Repair Yard on the Norfolk & Western at Portsmouth, Ohio

WHAT'S THE ANSWER?

Have you a question you would like to have someone answer?



Have you an answer to any of the questions listed below?

QUESTIONS TO BE ANSWERED IN THE JULY ISSUE

1. *What advantages, if any, are gained by using even joints ahead of turnouts in tracks where the joints are normally staggered?*

2. *What benefits are gained from chamfering the tops of treated piles in trestle bridges? Are these sufficient to counterbalance the damage to the timber caused by this practice?*

3. *Where it is the practice to cant the rails in main tracks, what are the advantages and disadvantages of canting them through turnouts?*

4. *What are the relative merits of the various types of roofing materials for roundhouses, from the standpoint of maintenance?*

5. *What is the best method of preventing the formation of gullies in ditches or other waterways on the right of way where the soil washes easily?*

6. *What can be done to retard or prevent the silting of reservoirs? What is the best method of removing silt after it has been deposited to such an extent as to reduce the capacity of the reservoir seriously.*

7. *To what extent is it economical to adze the ties in advance of rail relaying operations?*

8. *What practical field tests can be made to ascertain if stone or other coarse aggregates are suitable for concrete?*

Raising Track Out of Face

When track is raised out of face at regular intervals, what should be the procedure as regards tie renewals, additional ballast and other related items?

Renewals Should Be Made When Track Is Raised

By V. H. SHORE
Yard Foreman, Atchison, Topeka & Santa Fe, Dodge City, Kan.

When track is raised out of face at intervals of four years or more on main line main tracks, it should be given a general overhauling as regards tie renewals, line, gage, fastenings, additional ballast, and drainage where required. This work is usually done by extra gangs as the work required to make general repairs of this kind is too heavy for a section gang. When the raise is made, all decayed ties should be renewed and none left in track that will not last two years. This will greatly reduce the renewals to be made by the section gangs and also avoid disturbing the surface of the track seriously for a few years by heavy renewals. Ties taken out that are good for further service can be used in less important tracks or back tracks.

After the track has been surfaced and put in first-class line, all poor gage should be corrected, preferably each day, as bad gage will destroy good line under traffic. Slack places in the ballast should be filled out as soon as possible after a stretch of track has been thus overhauled to insure the track staying in good surface and line. Where track is not properly ballasted, the tamping will work loose under the ties, causing bad surface, which quickly results in poor line, with the liability of kicking out in hot weather.

Bolts should be tightened at this time as it is impossible to keep the joints in surface with loose bolts. When the track is raised and before the tamping is done, the ties should be straightened and spaced properly. Rail anchors should be adjusted to fit against the ties and last, but not least, drainage should be provided to keep water away from the track.

Spot in the Ties Before Raising the Track

By E. P. SAFFORD
Supervisor of Track, New York Central, Silver Creek, N. Y.

It is our practice, on a four-track, stone-ballasted line, to raise two tracks out of face each year, the eastbound tracks being raised one year and the westbound tracks in alternate years. Necessary tie renewals are made before the tracks are raised, and, if sufficient ballast is at hand, it is unloaded ahead of the surfacing, otherwise it is unloaded and dressed following the surfacing.

In so handling the work, it is necessary to bring the tie conditions gradually into such shape that only a minimum number will have to be spotted into the two undisturbed tracks. Since the use of creosoted ties was begun on these tracks 18 years ago, there are no heavy renewals to be made at present, and it does not pay to break into the surfacing work to put in ties. We, therefore, spot in the ties ahead of the surfacing, getting this work, as well as the cleaning up of the roadway, out of the way early in the season. The track is raised from 1 in. to 1¼ in. and the ties are tamped on both sides on the outside of the rail to a point well under the rail, but no tamping is done inside the rail except at joints or other locations where trouble has been experienced. The tamping is done with hand bars on some sections and with four-tool air tampers on others. The track is lined carefully after each day's work and at the same time any kinks in the previous day's work are removed.

While this method of placing ties does not agree with the practice of others who contend that they should be installed as the track is being raised, I feel that greater progress is made by avoiding the necessity of changing tools to pull in the ties while raising is going on. Incidentally, we do not raise the track sufficiently to permit pulling in the ties without disturbing the old bed, as otherwise we would have difficulty in meeting the fixed grades at bridges and crossings. Another consideration that leads us to dig the ties in is the fact that until four years ago, tie plates were applied only at the joints and centers on tangent track, so that the old ties are somewhat rail cut on a large part of the mileage. The ties put in ahead of the raising are tamped thoroughly when installed, "cocking" them slightly, and of course, they are tamped again when the track is raised.

Bolt tightening is done in the fall, winter and spring, and our gaging requirements are light, so that these do not interfere with the work. Our aim is to finish 500 ft. of track daily with a gang of eight men, including the foreman and track walker (the latter assisting in the work after going over the section), and we are usually able to complete this amount unless there are too many grade crossings or other features to delay the work.

Surface-Bent Rails

To what extent is it possible to straighten surface-bent rails? How can this be done?

Cannot Be Done Satisfactorily in the Field

By T. M. Pittman, Jr.
Roadmaster, Illinois Central, Water Valley, Miss.

It is not practicable to straighten surface bent rails and when they are bent badly enough to affect the riding condition of the track or materially increase the cost of maintenance, they should be replaced and used in low-speed tracks. Some foremen attempt to straighten the short bends that occur near the ends of the rail by a method commonly called "drifting," which is done by raising the joint a little stiff and tamping the joint tie solid while tamping the shoulder ties much lighter, thereby depending upon the weight of the train to bend the rail over the shoulder ties where the support is weaker and thus straighten it. Aside from failing to produce the desired results, this practice is objectionable as it is likely to damage the rail. The local forces do not have the equipment required for straightening the heavy rail now in general use and the only satisfactory method is to return the rail to some central plant equipped for the purpose. While this will give satisfactory results, the expense is prohibitive except where a large quantity of rail might be bent in the same locality.

Attempts Are Usually a Waste of Time

By Roadmaster

The time to straighten surface-bent rail is before it is bent and to do this it is necessary to keep after the joints to see that they are not allowed to remain low, since the trouble usually occurs near the end of the rail. Rails laid on newly constructed roadbeds are particularly subject to this, and as a consequence such tracks are now usually laid with a good quality of second-hand rail which is allowed to remain until the embankments have had a chance to settle.

On lines where the ends of the rails have become surface bent the only satisfactory remedy is to replace the rails and to saw the ends off of the released rails, if they are in good condition otherwise. If they are badly worn also, they should be used without sawing in yard tracks or other sidings which are not used as running tracks. Such rails should not be used in passing tracks on heavy-traffic lines.

Driving Piles with a Crane

What special precautions should be taken when driving piles by means of leads hung from the boom of a crane?

Leads Should Be Guyed

By G. A. Haggander
Bridge Engineer, Chicago, Burlington & Quincy, Chicago

While we prefer regular pile drivers for ordinary work on either maintenance or construction, we have found the use of a crane very desirable on certain small jobs where some pile driving must be done in addition to hoisting work, and also in locations remote from the tracks, as in relocation work, where a general purpose crane may be used for different kinds of work. In such cases, the use of the crane for this purpose obviates the expense of moving a regular pile driver to the site.

The only precaution we have found necessary is to guy the leads at the bottom to hold them in place. It is our practice to swing the leads by a heavy pin extending through the sides and passing through the end of the boom. We have one set of steel leads, but the others are made of wood.

While either a drop hammer or a steam hammer may be used, we prefer the latter and use it if available unless the crane to be used is too light to sustain the hammer at the desired radius. The steam hammer is much steadier when used in this way, as there is some tendency to swing the leads as the drop hammer is raised.

Leads Should Be Held in Position by Struts

By Assistant Bridge Engineer, Western Road

The best results will generally be obtained if the leads are held to proper position by means of guys or struts, preferably the latter. When driving piles on a batter it is all the more essential to employ struts for that purpose. Attempts have been made to drive piling by hanging a steam hammer from the end of a boom without the use of swinging leads, but this is rather a wobbly arrangement and it is difficult to keep the hammer and the pile on the same axis, causing the pile to get out of plumb through not being able to strike a square blow. Therefore, leads should be used where possible, held in place by struts.

When Goggles Should Be Worn

Under what conditions should track laborers be required to wear goggles?

Should Often Be Worn by Motor-Car Operators

By A. Chinn
Engineer Maintenance of Way, Chicago, Burlington & Quincy, Lincoln, Neb.

Track laborers should be required to wear goggles when cutting rails, nuts or other materials with a sledge and chisel as there is danger of flying particles of metal lodging in the eyes if they are not protected; this applies to the man using the sledge as well as to the man holding the chisel. Goggles should also be worn when sharp-

ening tools on emery wheels and when unloading cinders, sand or other fine materials that may be blown into the eyes.

In some parts of the country, flying insects become so prevalent at certain seasons of the year that it is necessary for men operating motor cars to wear goggles to insure proper vision at all times, and this is also necessary in those sections of the country which are subject to sandstorms.

Should Be Worn Whenever Necessary

By Supervisor

The obvious answer to this question is that goggles should be worn by track laborers whenever they are engaged in work where their use may save injuries to the eyes, especially when cutting steel with a chisel. Ordinarily only a few men will need to wear goggles at any time, but sometimes they should be used by every man in a section gang, and for that reason should be supplied so that this can be done. On extra gangs the work is usually divided in such a way that only a certain portion of the men will need them.

It is not enough to furnish the goggles; it is also necessary to see that the foreman requires them to be worn when they are needed. It is much easier to get into the habit of not putting them on when starting work which will last only a short time, but if this habit is changed to one that will insure their being put on when necessary, many injuries to the eyes will be prevented.

Emergency Stocks for Bridge Work

What factors govern the amount of material to be carried for emergency bridge work? Is it desirable to carry good second-hand materials in such stocks?

Inadvisable to Stock Second-Hand Materials

By I. L. Simmons

Bridge Engineer, Chicago, Rock Island & Pacific, Chicago

The amount of material to be carried at any one point depends on the total length of pile bridges in the territory to be served by that stock, together with the liability of washouts or fires. In certain territories, it is often advisable to take into account the probable amount of material for use in industrial tracks which may require trestle bridges. Such tracks are usually wanted in a hurry and it is not always possible to get material as wanted from the regular stocks.

Second-hand material should not be carried in emergency stocks, as it deteriorates very rapidly when removed from service and hence should be used in regular repairs as soon as possible. It is our practice to salvage timbers of standard sizes and lengths from falsework and to return them to the store department, which reissues them on requisitions for such work as they may be fitted.

No Objection to Good Second-Hand Material

By George W. Rear

Engineer of Bridges, Southern Pacific, San Francisco, Cal.

The amount of materials carried for emergency bridge work depends on the probable use to be made of the material and the accessibility of other sources of supply.

Most railroads know from past experience just about what can be expected in the way of fires, washouts, etc., and can carry stocks at various locations to meet the requirements or at least a sufficient supply to permit of work being carried on while additional material is being secured. The amount to be carried should be as small as consistent with the probable requirements and, of course, much depends on the ability of the supply department to fill emergency orders.

On railroads subject to periodical washouts or fires, it is good policy to carry material for about 300 ft. of standard trestle under load at suitable points, to meet requirements and such material should be put back into regular stock or used for other work at the end of the season, to avoid deterioration if held too long.

The use of good second-hand material is not objectionable, if it is available, but generally better use can be found for the second-hand material, and there is a temptation to hold such material from season to season and ultimately lose its value. The storage of new material for a few months, if properly piled, is an advantage on account of the better seasoning it secures.

Storing Gasoline for Section Use

What is the best method of storing gasoline at section headquarters for motor cars and other motorized equipment?

Tanks May Be Made From Old Air Reservoirs

By A. Chinn

District Engineer Maintenance of Way, Chicago, Burlington & Quincy, Lincoln, Neb.

The best method of storing gasoline at section headquarters for motor cars and other equipment is in small underground tanks, since these present the least fire hazard and also permit economical handling. The tanks may be made from old air reservoirs released from locomotives, or if these are not available, may be made from new galvanized sheet metal at a reasonable cost. The most convenient sizes for section use are of 75 or 100 gal. capacity. They should be equipped with a filling pipe, 1½ or 2 in. diameter, with a screw cap, and also with a hand pump. A lock should be provided for both the cap and the pump, to prevent the taking of gasoline by unauthorized persons.

The tank should be buried in the ground with the top of the filling pipe a few inches above the surface and the pump should be high enough to permit filling an ordinary service can. The tank should be placed in a convenient location where there will be little likelihood of anything striking the pump. The surface of the ground around the tank should be covered with cinders or other materials so that it can be kept clean and free from mud.

Should Be Stored in Underground Tanks

By O. Supernant

Roadmaster, Delaware & Hudson, Schenectady, N. Y.

We have underground storage tanks at our terminals from which all motor cars of the maintenance of way and signal departments are supplied. This tank is under the supervision of one man who has authority to have it filled when necessary. The tank is equipped with a pump covered by a wooden box fitted with a special lock and only foremen with motor cars are allowed to have keys. A record book is kept in the box, in which is entered the amount of gasoline taken by each man.

For sections away from terminals, an underground tank should be provided where it is convenient for at least two sections, and located, if possible, where tank wagons can deliver gasoline directly to it. On outlying sections where tank wagons cannot reach the tanks, the

gasoline should be shipped in barrels and the tanks should hold at least two barrels. All gasoline operated work equipment, except motor cars, tie tampers and similar tools, should carry their own supplies of gasoline in drums.

Floors for Freight Stations

What the relative merits of the different types of floors for large freight stations where heavy trucking is done?

This Depends on Service Conditions

By P. Aagard

General Building Inspector, Illinois Central, Chicago

There are five types of floors available and generally used in freight stations: wooden flooring, wood block, sheet asphalt or mastic, asphalt blocks and concrete. The life and maintenance of these different types will depend largely on the service to which they are subjected and other conditions to which they are exposed. The following remarks are premised upon good floors of the respective types, since poor materials and workmanship will often ruin a floor and make it unfit for any use.

Wooden floors of square-edged and end-matched maple give satisfactory results when not subject to impact from heavy objects or exposed to steam or other moisture, acids or alkalies.

Untreated wood block floors will withstand heavy impacts, but are injured by moisture, acids and alkalies. Creosoted blocks may be used unless foodstuffs or other commodities which might be contaminated by contact with creosote are likely to be placed on the floor.

Sheet asphalt or mastic floors on concrete bases may be used where shocks, steam, moisture, acids or alkalies are apt to be encountered, but should not be exposed to oils or too great a range in temperature. Oils have a tendency to disintegrate asphalt and great temperature ranges frequently cause sweating.

When traffic is so heavy and of such a character that frequent repairs may be necessary, the asphalt-block floor has an advantage over the sheet asphalt or mastic in the greater ease with which repairs can be made.

The concrete floor should not be used where other than rubber tires are used on trucks or where subject to jar or impact from hard and heavy objects. Otherwise, the concrete floor is very satisfactory.

Several Types Are Satisfactory

By A. T. Hawk

Engineer of Buildings, Chicago, Rock Island & Pacific, Chicago

We have used maple flooring, sheet asphalt or mastic, and concrete as floors for large freight stations and have had little trouble with any of these types when the proper precautions were observed.

We have maple floors which have been in service for more than 25 years and which are still in good condition where they have been protected from moisture. Where the trucking is heavy, we protect these floors by putting steel sheets as runways for the trucks. These runways should be bolted through the floor to members beneath the floor, since nails or screws will work loose, and the holes for the bolts should be countersunk so that the bolt heads will offer no obstruction to trucking. The sheets forming the runway should not be too long or trouble will be caused by expansion or contraction.

Wooden blocks, treated in such a way that there is no free oil or creosote on the surface, are also satisfactory, but care must be taken to see that a good foundation of concrete is provided. The same may be said of sheet asphalt, although this material will "sweat" when sudden changes of temperature occur. This is not usually serious and can be remedied by a light sprinkling of sand.

Concrete floors, if properly installed, wear well and are easily maintained if such cracks as occur are filled promptly with pitch. These floors are not easy to truck on when hand trucks are used, but since motors and trailers are now furnished to a great extent in large stations, this feature is not as important as it was formerly.

Locating Old Pipe Lines

How can old water mains or similar underground pipes be located when no record of their location is available?

Various Methods Are Described

By W. S. McCaleb

General Superintendent of Water Service, Pennsylvania System, Philadelphia, Pa.

One scheme which we have used with success is to pass a metal ball, with chain attached, or a pipe cleaner of the "Go Devil" type, through the pipe lines and follow the course of this equipment by the sound which it makes in passing through the pipe line, the rate of progress being controlled by the amount of water which is permitted to flow in the pipe line. This scheme requires training in the use of such apparatus, but it is reliable. The pipe line must be cut in at least two places for admitting and removing the ball or cleaner. These devices will not pass a 90 deg. bend or through a restricted valve in the pipe line. These, however, are not serious objections as it is simply necessary to open the pipe line at the obstruction to release the apparatus.

The serious objections to the use of this equipment are that it is difficult to use it with pipe lines smaller than six inches in diameter, and the cost of excavations for opening and closing the pipe lines, etc., is apt to be excessive. This method cannot be used where there are excessive extraneous noises.

In the event that the pipe line is known to be in the vicinity of an existing attachment thereto, such as a fire plug, faucet, line valve, etc., it can be located by using a geophone, transmittophone or electric leak detector, which are marketed by well-known water-service equipment houses. They are based on the stethoscope principle and are complete with head phones, collector apparatus, etc.

When used for the purpose under discussion, the procedure is as follows: Have an assistant tap a fire plug, faucet or valve at regular intervals with a hammer. With the head phones in place, systematically trace over the ground where it is suspected that the lost pipe line is located, by resting the collector plates on the ground or by pushing the collector pins into the ground, depending upon the instrument used. Devices having dual collectors are preferred. In using the latter, the idea is to let one collector remain fixed, and move the other collector slowly in a circle. If no results are obtained, reverse the process. When not in the vicinity of the lost pipe line, few if any of the sound waves will be picked up from the tapping by the assistant, but when over the pipe line they will be picked up in maximum volume. Obviously, having found one point over the line, other points can be located in a similar fashion. These devices are not entirely satisfactory if the topography over the lost pipe line is rugged, if there is snow or ice on

the ground, if the wind velocity is high or relatively so, or if these are other noises in the vicinity.

A device and method which have been developed by my organization and used with success for nearly twenty years are worthy of mention. An induction coil similar to those used on the old Ford cars, after having a wire placed across the high-tension contacts, is placed in series with a 6 or 12-volt battery to form what we may call the "sending apparatus." A head phone is then connected to a coil, which in our case is approximately 7 in. by 11 in., made up of a wooden frame on which there are several thousand turns of No. 40 wire. This equipment we will call the "receiving apparatus." The sending apparatus is connected to the lost pipe line at two known points by means of No. 14 wire. In our work we have used such a connection up to lengths of 1,200 ft. The operator, with head phones in place, then walks over the area in which it is suspected that the lost pipe line is located. When not over the pipe line, the operator gets a buzzing noise in the head phones, whereas when he is over the pipe line, the buzzing ceases. A point to point location can also be made by this method. The objections to this scheme are that the pipe line location must be known at two points; it requires excavation for at least one metallic connection with the pipe line, and, under some soil conditions, two metallic contacts with the pipe line are necessary.

In order to eliminate these objections, and at the same time secure a more sensitive apparatus, we have developed the following scheme, which has proved most satisfactory in the greatest number of cases. In this scheme, the sending apparatus includes a small six-volt motor for driving a high-speed circuit breaker similar to the circuit breakers used on automobiles. The motor-driven circuit breaker, two ordinary 45-volt "B" batteries, an intensifying coil, and several ground stakes constitute the sending apparatus. The motor can be driven by dry batteries or by a small storage battery, and a car or truck battery will provide sufficient power for several days of testing. The ground stakes are pointed galvanized pipes about one inch in diameter and about five feet long. The receiving apparatus includes the head phones, the exploration coil, as noted above, and an amplifier. The amplifier is two-stage and includes radio tubes and transformers, being placed between the exploration coil and the head phones to strengthen the signals picked up by the exploration coil.

The method adopted is as follows: The sending apparatus is connected in series with two stakes. With the motor turned on, the sending apparatus sends current into the earth through the stakes, which tends to swerve into any pipe line that may be in the area between the stakes. The motor-driven circuit breaker has a mechanical governor embodied in its construction and its vibrations, along with those of the motor, are absorbed by the carrier current from the "B" battery. One can plainly distinguish the motor and the breaker hum several thousand feet from the place it is running, by using the head phones and amplifier. When the sending apparatus is connected to stakes not very close to the lost pipe line, the operator picks up noises, whereas when the apparatus is connected to stakes very close to the pipe line no noise whatever is picked up by the head phones. We use 8 or 10 stakes as a rule. These are planted usually in a column of two's approximately 200 ft. between each of the two stakes in a row and approximately 200 ft. between rows.

By this method the operator is searching for the pair of stakes giving the least noise. With patience he will eventually get such a pair of stakes, perhaps after two or more plantings of the stakes. When this pair of stakes is found, one stake is left in position and the second stake is moved slowly from point to point in an arc, seeking a still quieter location. When this is obtained, the operation is repeated, reversing the fixed and moving stake. Finally, a position is found where no noise is picked up in the head phones, and it will be found that the stakes are comparatively close to the lost pipe line.

I believe that electrical methods such as these are more satisfactory than are the so-called "mechanical methods" first described, as the former are more positive and less subject to local interference. Any method used requires thought, ingenuity and patience. The electrical apparatus noted above was developed primarily for pipe-line leakage-survey work, for which purpose it is very well adapted. In all of the above it is presumed, of course, that the pipe line cannot be found by digging parallel trenches at regular intervals, resembling somewhat a gridiron effect.

Has Used Trenching Method Successfully

By L. C. Prunty
General Foreman, Water Service, Union Pacific, Kansas City, Mo.

My experience has been that when the location of a pipe line is not known the best way to find it is to uncover it at a valve or hydrant to ascertain its direction, and then to excavate narrow cross trenches at intervals along the line so established. As soon as a trench fails to uncover the pipe it is necessary to drop back and put in a trench about midway between the last two trenches to one side of the line, extending it to intercept the pipe line in its changed location. Often enough is known in a general way as to location of the pipe to know in which direction it has turned, but this is complicated by the possibility that 45-deg. bends may have been used instead of 90-deg. elbows. After the pipe has been found beyond the bend the same method as described above is followed until the next bend is reached and so on until the pipe has been located throughout its length. This method requires considerable labor, but will locate the pipe.

Oiling Rail Joints

A further answer to the following question discussed in the March issue:

What advantages, if any, are derived from oiling rail joints in dry climates where protection from brine drippings is not necessary? Does such oiling prevent the freezing of the joints and permit a readier adjustment of expansion and contraction?

Prevents Rust on Joints and Bolts

By H. C. Mann
Chief Engineer, Union Pacific System, Omaha, Neb.

A review of a canvass of this subject with all the various departments interested develops that it is the general opinion that rail joints should be oiled to prevent freezing, resulting in a more uniform movement of the rail in the joints on account of expansion and contraction. It is also the opinion that the joints should be swabbed with oil when the rails are being laid, as the rail enters the joint more easily, and that the joints should be painted with oil before the bolts are tightened, which is usually done during the winter months, to prevent rusting of the joints and the threads of the bolts.

New And Improved Devices

New Dixon Paints

THE Joseph Dixon Crucible Company, Jersey City, N. J., has made several additions to its paint products recently, including additional colors in the Industrial paints and the development of Utility and Maintenance Floor paints.

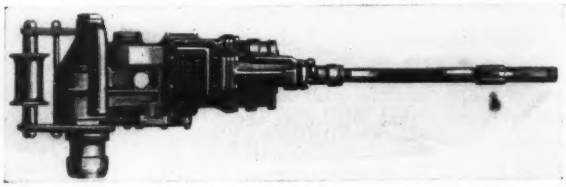
The range of colors in the Industrial paints, long known as Dixon's Silica-Graphite paints, has been increased from 8 to 14. Among the new colors are a straight aluminum paint and a standard red-oxide paint. The aluminum paint is made with a spar varnish as a vehicle, which, by reason of its resistance to the elements, insures the life and brilliance of the aluminum pigment, with no precipitation of the pigment.

The Utility paints are designed for "general run of work" to furnish a good protective coating at a lower cost than the Industrial paints. They are made in four standard colors, three of them being pigmented with graphite and the fourth with oxide of iron.

The Maintenance Floor paints have been developed for the protection of wood, composition linoleum, cement and concrete floors. Since they are immune to the action of alkali, they are well adapted for cement and concrete floors where they prevent "dusting." They are said to withstand the action of rain, sleet, snow and other climatic changes to a high degree and may be used either under cover or in the open, combining the functions of a deck paint, a floor enamel and a concrete coating. These paints are available in eight standard colors.

Ingersoll-Rand Develops New Pneumatic Track Wrench

THE Ingersoll-Rand Company, New York, has developed a new pneumatic track wrench, designated as Size 99C, which has been designed for ease in handling and which is said to be 50 per cent more powerful than the older types, with sufficient power



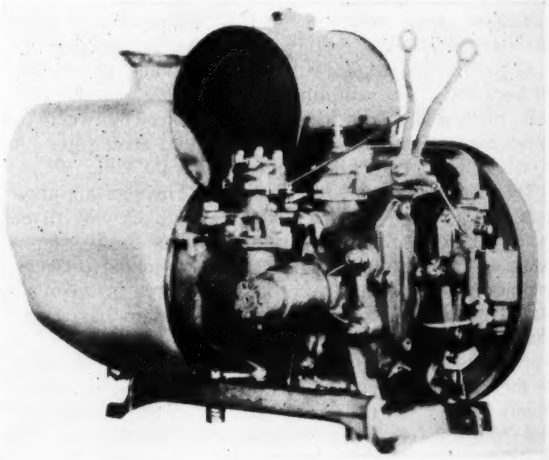
The Ingersoll-Rand 99C Pneumatic Track Wrench

to apply the nuts so that no final tightening with hand wrenches is necessary. The wrench may be moved easily from joint to joint along the rail by means of a dolly wheel, while a handle grip is provided to aid in applying the wrench to the nut, an improved clutch, which slips over the nut easily, facilitating this operation.

The air motor in the wrench is of a reversible, two-cylinder double-acting type, arranged compactly. A single valve is used, which is gear-driven at half the crank speed, thus providing exact timing, while wear is reduced by the slow speed of the valve and the fact that it operates under balanced air pressure. The power from the motor is transmitted to the spindle through a train of gears, so designed that their strength is proportioned to the torque at each particular gear. The final drive to the spindle is through a herringbone gear, providing strength with smooth and silent operation. For backing off nuts, the direction of rotation can be reversed by means of a latch located on the motor end of the wrench.

Fairmont Twin-Cylinder Type K Motor-Car Engine

A NEW twin-cylinder motor-car engine has been developed and placed on the market by Fairmont Railway Motors, Inc., which can be interchanged with the Fairmont QB single-cylinder engine, the base and bolt dimensions being the same in



The Pistons Counterbalance Each Other in the Fairmont Type-K Engine

both. The engine, including the sliding base, weighs 345 lb.

The new engine, which is designated as Type K, is nominally rated at 10 hp., but is said to develop 14 hp. There is a power impulse at every half turn of the crankshaft and, as all rotating weights are counterbalanced by weights drop-forged integrally with the crankshaft while the reciprocating weights oppose each other, there is a steady flow of power,

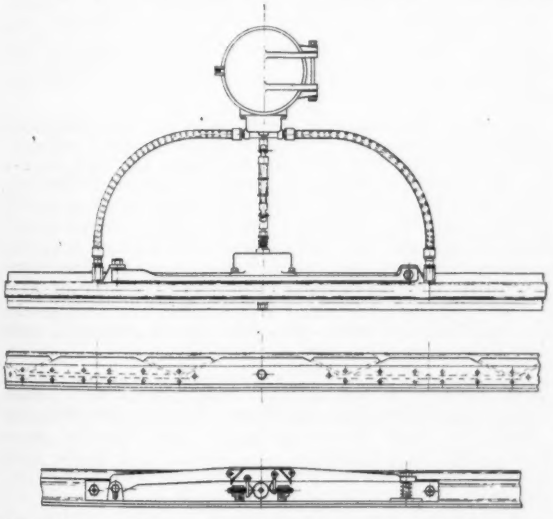
insuring smooth operation and easy riding. The flywheel simply steadies the load and plays no part in balancing the engine.

The design of the engine is simple and there are no valves in the explosion chamber, and no tappets, push rods or crankshafts. Full compression is maintained in each crankcase by "Ringseald" crankshaft packing of the piston-ring type, and the crankshaft is mounted on three ball bearings, one of which is placed between the crank throws. Backfiring is prevented by snuffers of honeycomb design in each by-pass. The engine is equipped with battery ignition, but a Robert Bosch high-tension magneto can be furnished as an extra. The water jacket is of such shape that it will not burst from freezing if it is not filled above the level of the water cock.

The Meco Automatic Rail and Flange Lubricator

THE benefits resulting from the lubricating of rails and wheel flanges in the reduction of wear, on both the rails and the wheel flanges, and the lessening of train resistance on curves have been definitely established. In order to furnish a device for this purpose which functions dependably under a wide range of climatic conditions, the Maintenance Equipment Company, Chicago, has designed and placed on the market the Meco automatic rail and flange lubricator which is said to have given the desired results in actual service.

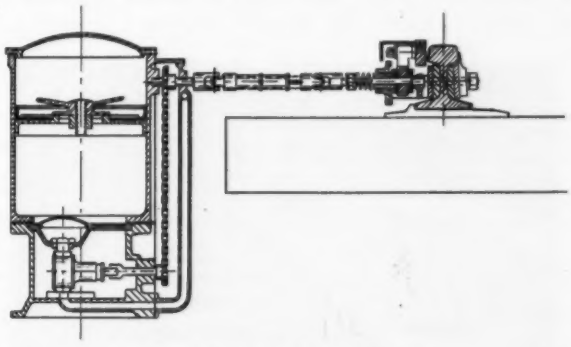
The device consists of a cast-iron reservoir containing a supply of the lubricant and a gear pump by which the lubricant is forced through hose connections to a distributing plate along the gage side of the rail in advance of the territory to be oiled.



Plan of Installation and Side Elevations of Distributing Bar and Ramp

The pump is actuated by a connection to a ramp located along the outer side of the rail. The ramp is depressed as the outer part of the tread of each wheel passes over it and returns to its normal position when the pressure is relieved by means of a coiled spring which supports one end of the ramp and which can be adjusted so that each downward stroke of the ramp will cause the pump shaft to rotate from 1/66 to 5/33 of a revolution. The rotation of the ratchet wheel in the reverse direction is prevented by a latch. The ramp and ratchet wheel are supported on a bracket bar which is fastened to the web of the rail by the same bolts which holds the distributing bar in place. A cover is provided to protect the device from injury from dragging equipment.

The distributing bar is made of special rolled steel and is machined to almost a feather edge where it comes in contact with the gage side of the rail. After a short period of service, it is said that this portion of the bar is virtually rolled into the rail, after which



Cross-Section of Installation

little further wear takes place. The bar is provided with passages for the lubricant, terminating in eight orifices spaced equidistant near the top of the bar. The passages are of the same size throughout so that equal volumes of lubricant are delivered to each orifice, and are picked up at eight points on the flange of each wheel.

The distributing plate is bolted to the rail by three ¾-in. bolts, one near each end and one at the center. In addition, two 1-in. hollow bolts which lead the lubricant from the metallic hose connections to the passages in the distributing car are also utilized as fastenings for the distributing bar.

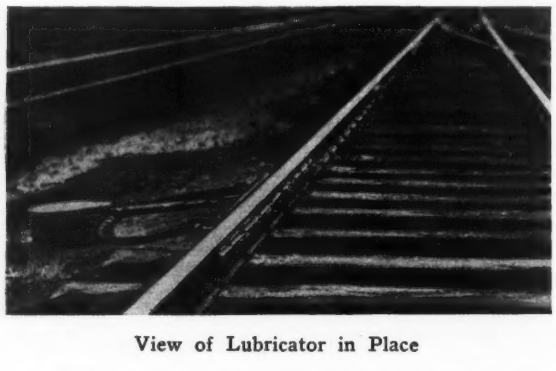
The reservoir containing the oil is equipped with a cover which can be locked in place or thrown back when desired for filling. Pressure on the lubricant is maintained by a piston which fits snugly in the cylinder and which is forced downward by atmospheric pressure as a partial vacuum beneath it is caused by the pumping of the oil, thus maintaining a constant supply to the pump, regardless of the viscosity of the lubricant.

To fill the cylinder with oil, the cover is thrown back and a relief valve is opened in the piston, permitting the entrance of air to break the vacuum. The piston can then be lifted readily from the cylinder and placed on the opened cover which acts as a shelf to keep the piston from becoming fouled by contact with the ground. After the cylinder has been filled the piston is replaced, the relief valve is closed, and the cover is closed and locked. From the bottom of the cylinder the lubricant passes through a strainer screen to a sump above the pump and thence is forced through the connections to the distributing plate as each train passes.

The lubricator should be installed at the point on the approach to the curve where flange wear on the rail first begins to show and should be applied to a rail with a full head. Since the only work necessary for installation is the excavation for the cylinder, which requires no special foundation, and the drilling of five holes in the web of the rail, together with the bolting of various parts and the connecting of the

mechanism, the installation can be made with the ordinary track forces.

The device will operate satisfactorily with any of the various lubricants used on rails on curves, but will have the greatest efficiency if the lubricant is of such consistency that it will issue from the orifices as a ribbon and remain without flowing until taken up by the wheel flange. In districts where there is no great range in temperature, one lubricant will serve, but in other localities one mixture should be used which will function as desired at temperatures of from 10 to 15 deg. below zero to 40 deg above zero for winter, while the summer lubricant should be



View of Lubricator in Place

such that it will preserve its ribbon form at temperatures ranging from 32 deg. to 90 deg. The amount of lubricant used depends on the number of wheels passing over the ramp and the volume of feed to the orifices. The latter can be regulated to suit local conditions, but the maximum quantity used should not exceed one gallon per 10,000 wheels lubricated.

Local conditions also govern the length of rails lubricated on curves. In service it has been found that one installation will lubricate effectively the high rails on 5,000 ft. of curved track, and in numerous cases considerably more, within three miles on one-way traffic. On single track, lubricators should be installed at each end of the territory to be protected to insure a fresh application of the lubricant by every passing train.

It is Today's Record that Counts

This is a day of breaking records. A new feat is accomplished or a new record is established, only to be surpassed in a very short time. One fellow no sooner says that a certain thing can not be done than some other fellow steps out and does that very thing.

Under such conditions, it is up to us to take stock and see if we are using the most modern methods in doing our work. Not a few foremen work along on some light-traffic line for years, doing passable work, and then wake up some day to find their section rebuilt for heavy traffic and that they, as foremen, are not qualified to run these same sections under new conditions.

And their failure to qualify under new conditions is not so much because of lack of experience as of proper disposition. If a man can run a branch-line section successfully, and has the ability to accept and execute instructions, he can qualify to run the heaviest section on any railroad. The fellows who fail when put to this test are those who have become self-satisfied, those for whom their job is only a means of making a living.

Some old fellow has his job taken away from him because he can't keep up his end under modern conditions and a big noise is raised about lack of appreciation of what he has done for the Company, etc. No one would use an ox team today for hauling freight; those of us who are still using methods of ten or twenty or even of only five years ago, are ox teams in an age of steam and motor transportation.

It is mighty fine to have a good record over a long number of years, it is not valueless by any means; but its chief value is that such a record is a pretty good indication of what one can do today. It is not so much what we did a year ago or last week or yesterday that counts as it is what we are doing today or what we are going to be able to do tomorrow. We cannot live on our past record.

How One Division Engineer Talks to His Men

One of a series of monthly bulletins to the foreman on the St. L-S. F.

With The Associations

Bridge and Building Association

The proceedings of the thirty-eighth annual convention which was held in Boston, Mass., on October 23-25, have come from the printer and are now being distributed to the members. These proceedings comprise a volume of 274 pages.

American Wood-Preservers' Association

The customary summer meeting of the executive and other committees of the American Wood-Preservers' Association, and the Wood Preservation committee of the American Railway Engineering Association, will be held at the Hotel Grim, Texarkana, Ark.-Tex., on Tuesday and Wednesday, May 21 and 22. Through the courtesy of the National Lumber & Creosoting Company and the International Creosoting & Construction Company arrangements will be made for all who attend this meeting to visit the Texarkana treating plants of these companies and to see the seasoning yards and the manufacture of ties and poles in the woods nearby.

In addition to committee meetings on Tuesday and Wednesday mornings and visits to the International and National plants on Tuesday and Wednesday afternoons respectively, there will be a "Get-together" dinner on Tuesday evening.

American Railway Engineering Association

Following the convention, the committee of the Board of Direction on personnel and outline of work of standing committees revised the assignments, issued to the various committees in January and published in our February issue, to include the following additional subjects:

Roadway—Develop and report upon the conditions which should govern the use of culverts in construction and maintenance, and the factors which determine the most suitable type to be used, collaborating with Committee on Masonry.

Ballast—Review and report revisions, if necessary, in specifications for washed gravel ballast. Make critical study of the cause and effect of pumping joints in railway track and the excess of cost of maintenance resulting therefrom, with suitable recommendations for removal of cause.

Ties—Continue the study and develop the best practice for switch tie renewals. Develop and recommend a traffic unit for use in comparing crosstie life.

Records and Accounts—Study and report on various forms used by railway water service departments, collaborating with Committee on Water Service and Sanitation.

Iron and Steel Structures—Study and report on proper means for track anchorage over bridges and similar structures, collaborating with Committee on Track and Committee on Wooden Bridges and Trestles.

In addition, Frank Ringer, chief engineer, Missouri-Kansas-Texas, St. Louis, Mo., has been appointed chairman on the Committee on Grade Crossings, to succeed F. J. Stimson, assistant chief engineer maintenance, Western region, Penna., Chicago.

The Committee on Economics of Railway Labor met at Chicago on March 30 with 13 members present. The Committee on Records and Accounts met at Cincinnati, Ohio, on April 9, with 12 members present. The Ballast committee met at Cleveland, Ohio, on April 20, the Water Service committee at Chicago, on April 23, and the Committee on Wooden Bridges and Trestles met at Chicago, on April 26.

RAILWAY NEWS BRIEFLY TOLD

Stevents Institute of Technology, Hoboken, N. J., has offered to the Pennsylvania a free scholarship for the college year, 1929-1930, to be given to a son of a living or deceased employee of that road. The scholarship includes board and lodging, as well as tuition, at a six-weeks' civil engineer camp in the summer of 1930. Applications for the scholarship are to be submitted to R. V. Massey, vice-president of the Pennsylvania at Philadelphia, Pa.

J. J. Mantell, formerly vice-president of the Erie, has been appointed consulting manager of the Chinese railways and will make a survey of these roads for the Nationalist government with a view to their reorganization along American lines. About 12,000 miles of lines will be covered by the study, including the Chinese Eastern in Manchuria, which is owned jointly by the Chinese and Russian governments.

Revenue freight car loading for the week ending April 13 totaled 971,739 cars, an increase of 59,071 cars over the corresponding week last year and an increase of 22,169 cars as compared with the corresponding week in 1927. The cumulative total for the first 15 weeks of the current year was 14,074,774, as compared with 13,624,207 and 14,444,593 in the corresponding period in 1928 and 1927, respectively.

Tracklaying on the Hudson Bay Railway has reached Ft. Churchill, Man., the terminus on Hudson bay, this having been made possible by laying the track on the ice and snow, thus permitting the shipment in of construction material for port development work before the spring thaw. Filling material and ballast will be placed after the advent of warm weather and it is not expected that the line will be opened for commercial traffic before the latter part of the summer or early fall.

Joseph M. Bramlett, section foreman on the Nashville, Chattanooga & St. Louis at Smyrna, Ga., has been awarded a bronze medal, together with $1,000 in cash, by the Carnegie Hero Fund Commission for his action in saving the life of a four-year-old child in an automobile which had stalled on a grade crossing in the path of a swiftly approaching train in that city. Mr. Bramlett, who has been a section foreman on the N., C. & St. L. since August, 1917, has had no personal injuries among his forces since December, 1921, during which period his men have worked a total of more than 150,000 man-hours.

Washington University, St. Louis, Mo., through Professor J. L. Van Ornum, announces the offer of a fellowship in civil engineering for the investigation of certain physical and mechanical properties of timber. The fellowship is open to graduates of recognized engineering schools who have had experience in technical research, and may be extended to two years, with a stipend of $1,000 for the academic year. The fellowship was established in co-operation with the American Creosoting Company, Louisville, Ky.

The maintenance of way department of the Kansas City Southern led all other departments of that road in safety records during 1928, with only 11 injuries, of which one was fatal, or one injury per 295,059 man-hours worked, as compared with 24 injuries, 2 of them fatal, in 1927, or one injury per 158,600 man-hours worked. The maintenance of way forces in the Kansas City Terminal went through the year with no injuries in 294,366 man-hours worked, while the same department on the Northern division, which led in individual records for all departments in 1927, was second in 1928, with four injuries, of which one was fatal, an average of one injury per 346,593 man-hours worked.

Trespassers to the number of 956 were killed on the Southern Railway in the seven years from 1922 to 1928, inclusive, an average of 137 each year, and the uniformity of the number of deaths in each year is shown by the fact that the minimum number in any of these years was 128 in 1925 and the maximum was 154 in 1923. In addition to the fatalities, the number of trespassers injured each year was quite uniformly about one-third more than the number killed. Of the 140 killed in 1928, 104 were trespassing on the tracks and the remainder on trains. As on most other American railways, the majority of the victims were not tramps, but useful citizens or children using the tracks as paths or boys playing around freight cars. The Southern operates 8,053 miles of line and has 2,318 locomotives.

New instructions relative to the appointments of officers in the Engineer Railway Battalions, Reserves, have been issued by the Adjutant General of the Army, rescinding the former instructions of March 14, 1927. Under the new regulations, it is possible to obtain original appointments in any grade not above that of major. Applications for appointment must be submitted on specified forms and where the position of battalion commander is concerned, the application must be accompanied by a recommendation by the president of the railroad to which the battalion is allocated or by such other executive officer of the railroad as may be designated by him. For subordinate positions, recommendation by the battalion commander will be forwarded with the application. No officer will be assigned or remain assigned to an engineer railway battalion allocated to a railroad when not an employee of that road.

The Supreme Court of the United States, in response to a petition of the Interstate Commerce Commission, has granted a writ of certiorari to the court of appeals of the District of Columbia providing for a review of the decision of the lower court which held that the commission had the power to compel the railways serving Los Angeles, Cal., to construct a union station. The commission had issued a certificate of public convenience and necessity, holding that the ability of the roads to serve the public properly would not be impaired by the construction of a terminal as desired by the city and the state, but that it was without power to order the construction of the station.

Carload shipments of the 29 principal commodities in the second quarter of 1929 will approximate 8,836,714 cars, an increase of 612,844 cars, or 7.5 per cent over the corresponding period in 1928, according to figures announced by the Car Service Division of the A. R. A. and based on estimates made by the shippers' regional advisory boards. These estimates show increases for 12 of the 13 regions, the only one for which a decrease is forecast being the Southeast region, where it is expected that there will be a falling off of 9,732 cars or one per cent. The largest regional increases are expected in the Midwest and Allegheny regions, where they are estimated at 17.5 and 14 per cent, respectively. By commodities the largest increases are forecast for citrus fruits, 47.5 per cent; automobiles, trucks and parts, 17.7 per cent; grain, 15.4 per cent, and coal and coke, 14.7 per cent. Of the nine commodities in which decreases are expected, the largest reductions, 10.9 per cent in each case, are estimated for hay, straw and alfalfa, and for fresh vegetables other than potatoes.

Construction News

The Atchison, Topeka & Santa Fe has awarded a contract for the construction of the substructure, consisting of concrete piers on caissons, of a bridge over the North Canadian river at Oklahoma City, Okla., to the Union Bridge Company, Kansas City, Mo.

Contracts for the construction of a laundry building at Newton, Kan., and a reinforced concrete feed storage elevator at the stock yards at Emporia, Kan., have been awarded to the T. A. Allen Construction Company, Los Angeles, Cal. A contract has been let to Joseph E. Nelson & Sons, Chicago, for the construction of fuel oil pipe lines and facilities for supplying locomotives at Emporia.

The Baltimore & Ohio has awarded a contract to the Empire Construction Company, Baltimore, Md., for the construction of its section of the new Hanover street viaduct in Baltimore.

The Bangor & Aroostook has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of a reinforced concrete coaling station at Derby, Me.

The Boston & Maine has awarded contracts to the New England Construction Company, Springfield, Mass., for the rebuilding of three bridges on its lines.

This company is planning the construction of a modern locomotive terminal to cost approximately $1,500,000, in its Boston, Mass., yards. The enginehouse will be equipped with a direct steaming system. A large coaling station will also be constructed, with a steel overhead pocket of 2,000 tons capacity, and equipped with automatic hoisting machinery. The roundhouse will have 50 stalls and a 110-ft. turntable will be installed.

The Canadian National closed bids on March 22 for the construction of water stations at Dobson, Alta., and Scott, Sask., which will include the construction of dams, reservoirs and pipe lines.

The Canadian Pacific has announced, as part of its general improvement program, the construction of buildings and other structures at various points on its lines in Manitoba, British Columbia, Ontario, Saskatchewan and Alberta in 1929. Ten new stations will be constructed, and an assistant superintendent's house will be built at Wilkie, Sask., while roadmasters' houses will be built at Bassano, Alta., and Empress and 13 section houses will be constructed at various points. It is planned to construct coaling stations at Strasbourg, Sask.,

A contract has been awarded to the Hamilton Bridge Company, Hamilton, Ont., for the construction of four bridges on the lines of this company in British Columbia at a cost of about $800,000. Contracts have also been let for the grading of 99 miles of branch lines in Alberta and Saskatchewan, as follows: From Coronation, Alta., to Youngstown, 41 miles, and from Acme, Alta., northwest 25 miles, to Fred Mannix, Calgary, Alta.; from Bromhead, Sask., west to Lake Alma, 18 miles, to Riley & Reed, Edmonton, Alta.; from Willingdon, Alta., northwest 15 miles, to Roosa & Wickstrand, Vermilion, Alta.

The Chesapeake & Ohio has awarded contracts as follows: To John W. Cowper Company, Inc., Richmond, Va., for a new enginehouse and shop facilities at Clifton Forge, Va.; to F. H. Clement & Co., Bethlehem, Pa., for grading and masonry work in connection with the extension of tracks and the relocation of main lines at Hinton, W. Va.; to Haley, Chisholm & Morris, Charlottesville, Va., for grading and masonry included in improvements at Russell, Ky., to cost about $1,433,000; to Boxley Brothers Company, Orange, Va., for converting the present railroad bridge over the Ohio river between Covington, Ky., and Cincinnati, O., into a highway bridge; to the Reed Laysley Company, Inc., for grading and masonry work for a connecting track between the Kanawha & West Virginia at Beech Glen, W. Va., and the Chesapeake & Ohio at Bryce, W. Va., including a bridge over the Gauley river, the total cost of the entire project being estimated at $221,348.

Five contracts have been awarded to Fairbanks, Morse & Co., Chicago, as follows: For a coaling station, sand handling facilities and cinder conveyors included in the engine terminal improvements at Fulton, near Richmond, Va.; for similar work both at Hinton, W. Va., and at Stevens, Ky.; for a coaling station and sand handling facilities included in engine terminal improvements at Cheviot, Ohio; and for sand handling facilities at Clifton Forge, Va. These contracts are a part of this road's improvement program amounting to $18,500,000. A contract has been let to Joseph E. Nelson & Sons, Chicago, for the construction of an addition to the roundhouse, a storehouse, a coaling station and various other terminal buildings at Fulton (Richmond), Va.

The Chicago & North Western has awarded a contract to Peterson, Shirley & Gunther, Omaha, Neb., for the construction of an extension from Winner, S. D., to Wood, 34 miles, which includes grading, bridging and track laying and involves a total expenditure of about $1,250,000.

The Chicago, Rock Island & Pacific has applied to the Interstate Commerce Commission for authority to construct a line from Shamrock, Tex., to Quanah, and from Quanah to a point of connection with the St. Louis, San Francisco & Texas in Wilberger county, 108 miles.

The Cleveland, Cincinnati, Chicago & St. Louis has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of a 600-ton reinforced concrete automatic electric coaling station at Linndale (Cleveland), Ohio.

The Delaware, Lackawanna & Western is preparing plans and will soon receive bids for the elimination of a grade crossing on its lines in Elmira, N. Y., at an estimated cost of $250,000.

The Emerson-Churchill Colonization Railway has petitioned the Manitoba legislature for authority to construct a railroad from Emerson, Man., near the Minnesota-Manitoba border, through Waboden, Man., on the Hudson Bay Railway, to Fort Churchill on Hudson Bay, about 1,000 miles.

The Erie has awarded a contract to the Newhall Company, Cleveland, Ohio, for the construction of a freight house and team track yard at Black Rock, N. Y., north of Buffalo.

A contract for the construction of a 7,000-ton capacity four-track reinforced concrete automatic electric coaling station with sand handling equipment and cinder handling plants at Meadville, Pa., has been awarded to the Roberts & Schaefer Company, Chicago.

The Grand Trunk Western has awarded a contract for the construction of the uncompleted section of a belt line around Pontiac, Mich., to P. T. Clifford & Son, Valparaiso, Ind. The cost of the work is estimated at $1,500,000.

The Kansas City, Mexico & Orient of Texas has applied to the Interstate Commerce Commission for a certificate authorizing the construction of a line from Alpine to Presidio, Tex., on the Rio Grande, 86 miles, to connect the line in the United States with that of the company's Mexican subsidiary.

The Lehigh Valley has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of a 1,700-ton capacity automatic electric coaling and sanding plant at Coxton, Pa.

The Missouri-Kansas-Texas has let a contract to Gifford-Hill & Co., Inc., Dallas, Tex., for a reduction of the eastbound ruling grade on the Henrietta division, between St. Jo., Tex., and Nocona, 16 miles, to a virtual 0.8 per cent maximum. The total cost of this work will be about $420,000.

A contract has been awarded to the Bellows-Maclay Construction Company, Dallas, Tex., for improvement and enlargement of the locomotive terminal facilities at Fort Worth, Tex., at a cost of about $450,000. This project includes the rearrangement and construction of approximately 3 miles of trackage, the installation of a 105-ft. continuous type turntable and the construction of a 10-stall roundhouse, a water-treating plant and various other buildings.

The Missouri Pacific has awarded a contract to the Gauger-Korsmo Construction Company, Memphis, Tenn., for the construction of an engine shop and machine shop at Poplar Bluff, Mo., at a cost of $153,000.

The Nevada-California-Oregon, a subsidiary of the Southern Pacific, plans the expenditure of about $325,000 for the construction of shops and terminal facilities at Alturas, Cal.

The New York Central has awarded a contract to H. H. Sherwin & Co., Inc., New York, for the construction of a new six-story automobile storage warehouse at 230th street and Kings Bridge road in New York. The building will cost about $500,000 .

Application has been made to the Interstate Commerce Commission for authority to build a cutoff line on its Putnam division between Briarcliff Manor station and East View station, N. Y., which will reduce the distance from 6.03 to 4.6 miles, and to abandon the old line.

The New York, New Haven & Hartford plans the improvement of two yards on its lines at Providence, R. I., and at Cedar Hill, near New Haven, Conn., to cost approximately $1,750,000, and to include changes in the tracks, humps, signaling devices and lighting. Forty-four retarder units will be installed in the two classification yards at Cedar Hill, controlled by six towers, and 19 units at Providence, with two towers.

The Nicholas, Fayette & Greenbrier and the **New York Central** have let subcontracts for a 28-mile extension between Swiss and Nallen, W. Va., as follows: To A. Keathley, Charleston, W. Va., for grading, concrete structures and ballast; to Piper & East, Charleston, and to Brown, Murphy & Wright, Princeton, W. Va., for grading and concrete structures; to Poston, Brewer & Brewer, Chillicothe, Ohio, for grading and concrete structures. A. Guthrie & Co., Swiss, W. Va., has the general contract.

The Northern Pacific and the **Oregon-Washington Railroad & Navigation Company** have filed with the Interstate Commerce Commission an application for authority for joint construction of a 60-mile branch line in the Gray's Harbor district, Washington, extending from a connection with the Northern Pacific at Aloha, north through the Olympic peninsula forest region to the south bank of Hoh river. The cost is estimated at $6,000,000.

The New York, Ontario & Western plans the elimination of a grade crossing on the state highway crossing its lines north of Morrisville, N. Y., at an estimated cost of about $130,000.

The Pennsylvania has let contracts to the John F. Casey Company, Pittsburgh, Pa., for the reconstruction of tracks, driveway paving, and inspection platform to complete the produce yard east of Sixteenth street in Pittsburgh and the grading, drainage, foundations, paving and track work in connection with the new freight houses fronting on Eleventh street to cost approximately $350,000, and to the McClintic-Marshall Company, Pittsburgh, Pa., for the renewal of a bridge on its line over the Tuscarawas river near Gnadenhutten, Ohio., the whole project to cost approximately $130,000.

A contract has also been awarded to James Stewart & Co., Inc., New York, for the construction of its new 22-story office building which is to be located on Pennsylvania boulevard, between Sixteenth and Seventeenth streets in Philadelphia, Pa. Below the street level, the building will be a part of the Pennsylvania's new suburban station.

The construction of a new passenger station is planned at Pittsburgh, Pa., which will be located to face on Penn avenue between Eleventh and Thirteenth streets.

The Southern Pacific has awarded a contract for the grading for a branch line from Knight's Landing, Cal., to a point near Boyer's Landing, 13.8 miles, to W. A. Bechtel, San Francisco, Cal.

The St. Louis-San Francisco has awarded a contract to the Reid & Lowe Construction Company, Birmingham, Ala., for the construction of about two miles of industrial and interchange trackage at Memphis, Tenn., extending from the Yale Terminal south and west to a connection with the Illinois Central. The cost of this construction will be about $100,000.

The St. Louis Southwestern has been authorized by the Interstate Commerce Commission to construct a line extending from a connection with the Gideon & North Island at Gideon, Mo., southerly to a connection with the Deering & Southwestern at Deering, Mo., approximately 20 miles, and to construct a line from a connection with the Deering & Southwestern at Hornersville, Mo., southwesterly to Leachville, Ark, approximately 11 miles.

The Terminal Railroad Association of St. Louis has let a contract to the Roberts & Schaefer Company, Chicago, for the furnishing of a multiple-pit three-track electric cinder-handling plant for installation at St. Louis, Mo.

The Union Pacific will bear 50 per cent of the cost of a contract which has been let by the City of Cheyenne (Wyo.) to Archie Allison, Cheyenne, for the construction of the substructure and concrete deck of a viaduct over the Union Pacific tracks at Central avenue in that city.

This company and the Chicago, Burlington & Quincy have reached an agreement for the improvement of their passenger terminal facilities at Omaha, Neb., which when completed will combine the two stations into one union station at a cost of about $4,200,000. The Union Pacific will build an entirely new station on the site of the present union station at a cost of $3,500,000, while the Burlington will remodel its present station at a cost of $700,000.

The Western Pacific plans to begin work within 60 to 90 days on the construction of extensions to the passing tracks at Pulga, Cal., and Belden which will have lengths of 1,859 ft. and 1,964 ft. respectively, at respective costs of $98,720 and $94,185.

Supply Trade News

General

The Dearborn Chemical Company, Chicago, has moved its New York office to 205 East Forty-second street.

Fairmont Railway Motors, Inc., Fairmont, Minn., has moved its New York office to 2612 Grand Central Terminal building.

The Industrial Brownhoist Corporation, Cleveland, Ohio, has moved its Pittsburgh office from the Oliver building to the new Koppers building.

The Sullivan Machinery Company, Chicago, has moved its general office from the Peoples Gas building, Chicago, to the Wrigley building.

The American Track Barrow, Lowell, Mass., has appointed the Hopkins Company, Marquette building, Chicago, as representative for the Western territory.

The Page Steel & Wire Company, Bridgeport, Conn., has moved its New York office from the Grand Central Terminal building to the New York Central building.

The Toledo Scale Company, Toledo, Ohio, has purchased 80 acres of land at Toledo as a site for new factory building which is expected to be ready for use by January, 1930.

The Whiting-Adams Company, Boston, Mass., has established a branch sales office at 30 Church street, New York. **Charles A. Darby, Jr.,** district sales manager is in charge of the new office.

The Curtin-Howe Corporation, New York, has licensed the Pendleton-Gilkey Company, Minneapolis, Minn., to treat forest products of all kinds by the ZMA (zinc-meta-arsenite) process at its Spokane, Wash., plant.

The Buda Company has awarded a contract to the Austin Company, Cleveland, Ohio, for the construction of an addition to its Halsted street foundry at Harvey, Ill. The building, which was planned by the Austin Company, will be a one-story steel-frame structure, 60 ft. by 100 ft.

The General Cable Corporation, New York, and the **Copperweld Company,** Glassport, Pa., have entered into an agreement whereby the former company is appointed exclusive agent in the United States to draw wire from Copperweld rods and to sell wire so drawn and products made therefrom.

The United Engineers & Constructors, Philadelphia, Pa., has organized the United Engineers & Constructors (Canada), Ltd., to handle engineering and construction work in Canada. The new company, of which **R. M. Henderson** is managing director, has headquarters in the Drummond building, Montreal, Que.

Personal

Stanley H. Smith has been appointed Eastern representative of the Electric Railweld Sales Corporation, Chicago, with headquarters at Cleveland, Ohio.

H. M. Schaaf has been appointed manager of steel door sales of the Truscon Steel Company, Youngstown, Ohio.

John T. Logan, president of the National Lumber & Creosoting Company, Texarkana, Ark., died on April 12 at St. Louis, Mo.

Henry A. Barren, vice-president in charge of operation of the American Steel & Wire Company, Chicago, has resigned after 52 years' service.

W. J. Denholm of the Chicago office of the Worthington Pump & Machinery Corporation, New York, has been appointed assistant to the manager of the Harrison works at Harrison, N. J.

C. H. Wilson, representative at Chicago of Fairbanks, Morse & Co., has been promoted to district manager, with headquarters at St. Louis, Mo., to succeed **H. L. Hileary,** who has been transferred to New York.

F. S. Shinn, chief lumber inspector of the Chicago, Burlington & Quincy, with headquarters at Chicago, has been appointed special agent of the Curtin-Howe Corporation, New York, with headquarters at Chicago.

A. R. Gelinas has been appointed agent for Ontario, Quebec and the Maritime Provinces of Canada for the American Hoist & Derrick Company, St. Paul, Minn., with headquarters at 1434 St. Catherine street, West, Montreal, Que.

C. F. Hopkins, formerly assistant to the president of the E. A. Lundy Company and vice-president of the A. & H. Corporation, has been elected president of the Hopkins Company, Chicago, which has been organized to sell railway and industrial supplies.

W. D. Keeney, district engineer of the Wyoming State Highway department, and **Ralph H. Mann,** assistant secretary of the American Society of Civil Engineers, have been appointed field engineers for the service bureau of the American Wood-Preservers' Association.

T. D. Crowley, railway supplies, Chicago, has moved his office from the Peoples Gas building to Willoughby Tower, 8 South Michigan avenue. He has also recently been appointed representative of the Chicago territory for the Keyston Grinder & Manufacturing Company of Pittsburgh.

W. J. Smith, tie and timber agent of the Missouri-Kansas-Texas, with headquarters at Denison, Tex., has resigned to become president of the newly-formed W. J. Smith Wood Preserving Company, Denison, Tex. Mr. serving Company, Denison, Tex., which will treat all the ties and timber required for the M-K-T as well as similar materials for other roads up to the limit of its capacity.

Roy F. Respasz, formerly with William Robertson & Co., has been appointed manager of railway sales of the Fairfield Engineering Company, Marion, Ohio, designers and builders of Fairfield locomotive coaling equipment and cinder conveyors. Mr. Respasz' headquarters will be in the office which that company has opened in the Transportation building, Chicago.

Charles Philip Coleman, formerly president of the Worthington Pump & Machinery Corporation, New York, died on April 13 at Washington, D. C., at the age of 64. Mr. Coleman was in the service of the Lehigh Valley in various positions from 1887 to 1898, following which he was with the Bethlehem Steel Company for about a year. He subsequently returned to the Lehigh Valley as purchasing agent, resigning in 1903. Mr. Coleman was elected president of the Worthington Pump & Machinery Corporation in 1918 and served in that position until 1926.

H. M. Butters, formerly manager of the railroad sales department of Beaver Products, Inc., has been appointed manager of the railway sales department which has been established by the Federal Cement Tile Company, Chicago. Mr. Butters was born in Chicago on July 24, 1890, and graduated from the University of Illinois in 1912,

H. M. Butters

entering the service of the Johns-Manville Corporation in the same year as a railway sales engineer, with headquarters in Chicago. During 1917, he was manager of boiler and engine construction for the Emergency Fleet Corporation at Chicago, returning to the Johns-Manville Corporation after the war. In 1919, he was appointed district sales manager for the Franklin Manufacturing Company, Franklin, Pa., with headquarters at Chicago, and in 1921 was appointed manager of the railroad sales department of Beaver Products, Inc. When this company was purchased by the Certain-Teed Company in April, 1928, Mr. Butters resigned to engage in research work on roofing material for various companies, in which activities he was engaged at the time of his recent appointment as manager of railway sales for the Federal Cement Tile Company.

Personal Mention

General

C. J. Geyer, engineer maintenance of way of the Chesapeake & Ohio, has been promoted to assistant to the vice-president in charge of operation of that road and the Hocking Valley, with headquarters at Richmond, Va. Mr. Geyer was born on April 6, 1889, at Zanesville, Ohio, and entered railway service in May, 1908, in the construction department of the Grand Trunk Pacific. In the following year he entered the service of the C. & O. where he served as a rodman and instrumentman until 1913, when he was promoted to assistant engineer on the Huntington division. In 1918, he was promoted to division engineer, with headquarters at Richmond, Va., and this was followed in 1924 by his further promotion to assistant superintendent maintenance of way, with headquarters at the same point. Mr. Geyer was promoted to engineer maintenance of way in October, 1926, which position he was holding at the time of his recent promotion to assistant to vice-president on April 15.

A. C. Shields, general manager of the Denver & Rio Grande Western, with headquarters at Denver, Colo., who is an engineer by training and experience, has been elected vice-president and general manager of that road, with headquarters at the same point. Mr. Shields was born in Iowa and was educated at Iowa State College. He entered railway service in 1898 in the engineering department of the Chicago, Rock Island & Pacific, where he served in various capacities until March, 1913, when he was promoted to division engineer, with headquarters at Little Rock, Ark. He was transferred to Trenton, Mo., in 1916, and in August, 1923, was appointed engineer maintenance of way of the Denver & Rio Grande Western, with headquarters at Denver. He was promoted to assistant general manager in 1925 and on April 1, 1927, he was further promoted to general manager, which position he was holding at the time of his recent election as vice-president and general manager.

Engineering

George W. Christians has been elected vice-president and chief engineer of the Tennessee, Alabama & Georgia, with headquarters at Chattanooga, Tenn.

T. P. Rollow, Jr., has been appointed division engineer of the Northern division of the Gulf, Colorado & Santa Fe, with headquarters at Cleburne, Tex., succeeding **W. G. Massenburg,** deceased.

W. H. Moulthrop, office and field manager in the engineering department of the Southern Pacific, has been promoted to assistant to the chief engi-

neer, with headquarters at San Francisco, Cal.

George P. Smith, consulting engineer of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Cincinnati, Ohio, retired from active service on April 1 in accordance with the pension rules of that road.

R. N. Angier, chemical engineer of the timber-treating plant of the Baltimore & Ohio at Green Springs, W. Va., has been promoted to assistant supervisor of timber treating plants, with headquarters at Green Springs.

F. P. Sisson, division engineer on the Grand Trunk Western, with headquarters at Detroit, Mich., has been promoted to principal assistant engineer, with headquarters at the same point. **A. N. Laird,** assistant engineer at Detroit, has been promoted to bridge engineer with headquarters in the same city.

W. J. Kernan, bridge and building inspector on the Mohawk division of the New York Central, with headquarters at Albany, N. Y., has been promoted to assistant division engineer of the Rochester division, with headquarters at Rochester, N. Y., succeeding **G. T. Donohue** who has been transferred to the Syracuse division with headquarters at Syracuse, N. Y., to succeed **F. G. Smith.**

M. M. Churchill, roadmaster on the Kamloops division of the Canadian National, with headquarters at Kamloops Junction, B. C., has been promoted to acting division engineer of the same division, to take the place of **S. J. Munroe,** who has been transferred to the Vancouver Island division, with headquarters at Victoria, B. C., to succeed **H. L. Johnson,** acting district engineer, who has retired.

D. C. Fenstermaker, who has been on an extended leave of absence from the engineering department of the Chicago, Milwaukee, St. Paul & Pacific, has been promoted to district engineer of the Southern district, excluding the Terre Haute division, with headquarters at Chicago, succeeding **C. T. Jackson,** who has been promoted to special engineer, with headquarters in the same city. During his leave of absence, Mr. Fenstermaker was chief engineer of the North & South with headquarters at Itasca, Ill.

F. H. Rothe, supervisor on the Pittsburgh division of the Pennsylvania, with headquarters at Trafford, Pa., has been promoted to assistant engineer in the office of the chief engineer maintenance of way of the Western region at Chicago. **R. L. Haring,** supervisor on the Long Island, with headquarters at Jamaica, N. Y., has been assigned to special duty in the office of the chief engineer maintenance of way (New York zone) of the Pennsylvania, with headquarters at New York City.

Chester A. Johnston, whose promotion to division engineer on the Wabash, with headquarters at Montpelier, Ohio, was noted in the March issue, was born on September 1, 1895, at Logansport, Ind., and was educated at Purdue University and the University of Arizona. He entered railway service on June 12, 1917, in the engineering department of the Pennsylvania where he served as an instrumentman and assistant on engineer corps on the Louisville division at Louisville, Ky., until February 1, 1920, later serving as an assistant on engineer corps on the Indianapolis division at Indianapolis, Ind., and on the St. Louis division at Terre Haute, Ind. Mr. Johnston became an assistant engineer on the Decatur division of the Wabash at Decatur, Ill., on May 17, 1924, and on August 1, 1926, was promoted to resident engineer in charge of second track construction at Adrian, Mich. On August 1, 1927, he was appointed track supervisor on the Chicago Terminal division, which position he was holding at the time of his recent promotion to division engineer.

Adrian B. Chaney, whose promotion to division engineer on the Missouri Pacific, with headquarters at McGehee, Ark., was noted in the March issue, was born on October 10, 1892, at Magazine, Ark., and was educated at the School of Mines of the University of Missouri. He entered railway service in 1906 as a clerk on the Chicago Rock Island & Pacific, continuing in this position until 1908; he was also in the service of the Missouri Pacific in 1910 and 1911. After completing his college course in 1914, he became a rodman on the Southern Pacific and in 1915 entered the employ of the Missouri Pacific in a like capacity, being promoted successively to ballast inspector, instrumentman, and rail inspector until 1920, when he was promoted to roadmaster, with headquarters at Paris, Ark. He was later promoted to assistant engineer, with headquarters at Van Buren, Ark., which position he was holding at the time of his recent promotion to division engineer. During the World War, Mr. Chaney served in the 7th and 312 Engineers in the United States Army.

Lyde A. Henry, sanitary inspector on the Missouri Pacific, with headquarters at Little Rock, Ark., has been promoted to landscape engineer of the system, with headquarters at St. Louis, Mo. **C. B. Huffman,** assistant engineer, with headquarters at Falls City, Neb., has been promoted to division engineer, with headquarters at Van Buren, Ark.

Mr. Henry was born in Arkansas on July 1, 1893, and entered railway service in October, 1912, as a rodman on the Missouri Pacific. From April, 1913, to October, 1920, he was engaged in work with private engineering firms and with the United States Engineers on drainage, highway and river protection work in Arkansas and Louisiana in positions ranging from rodman to resident engineer. He returned to the Missouri Pacific in October, 1920, as an instrumentman on the Memphis division at Wynne, Ark., and later was transferred to the office of the engineer of public improvements at Little Rock. In March, 1924, he was promoted to sanitary inspector at that point, which position he was holding at the time of his recent promotion to landscape engineer.

C. O. Long, whose promotion to assistant division engineer on the Pennsylvania at Fort Wayne, Ind., was noted in the April issue, was born on September 1, 1887, at Renova, Pa., and was educated at Bucknell University, where he was graduated in 1909. He entered railway service on the Pennsylvania on June 1, 1907, during his summer vacation as a rodman on the Allegheny division and returned to the Pennsylvania in the summer of 1908 as a laborer on the same division. After his graduation he became a rodman in the office of the engineer maintenance of way of the Pennsylvania at Philadelphia, Pa., on October 4, 1909, being transferred successively to the Bellwood division and to Altoona, Pa. In July, 1914, he was promoted to transitman at Philadelphia, and in May, 1915, he was promoted to assistant supervisor at Cresson, Pa., later serving at Lock Haven, Pa., and Philadelphia. In March, 1920, he was promoted to supervisor at Phillipsburg, N. J., and in November, 1923, he was appointed assistant trainmaster at the Greenville terminal, Jersey City. In January, 1925, he was appointed supervisor on the New York division at Trenton, N. J., where he remained until his recent promotion to assistant division engineer.

Walter Sebastian, assistant engineer on the Reading at Philadelphia, Pa., has been promoted to resident engineer at that point to succeed **Edwin F. Dawson,** who has retired after 47 years' continuous service with that road. **George H. Seitz,** assistant engineer at Reading, Pa., has been promoted to resident engineer, with headquarters at the same point, succeeding **Paul Voorhees.**

Mr. Sebastian entered engineering work on August 8, 1895, with the city of Williamsport, Pa., and became a transitman on the Reading at that place on April 7, 1899, later being transferred to Philadelphia. On March 26, 1900, he entered the service of the Pennsylvania in the maintenance of way department at Renovo, Pa., returning to the Reading on June 14 of the same year, where he was employed in the chief engineer's office. In October, 1909, he was promoted to assistant engineer in charge of survey work and the preparation of maps, which position he was holding at the time of his promotion to resident engineer.

Mr. Dawson was born on March 10, 1859, in Philadelphia, and graduated from the University of Pennsylvania in June, 1880. After leaving college, he entered the employ of the United States Government on harbor work at Philadelphia. He entered the Reading service on April 1, 1882, as an assistant engineer on construction and in the following year was transferred to

the chief engineer's office at Philadelphia. He was later promoted to resident engineer in the same office and was holding that position at the time of his retirement.

Richard Brooke, assistant engineer maintenance of way of the Chesapeake & Ohio, with headquarters at Richmond, Va., has been promoted to engineer maintenance of way, with headquarters at the same point to succeed **C. J. Geyer,** whose promotion to assistant to vice-president is noted elsewhere in this issue. **J. E. King,** general supervisor of bridges and buildings, with headquarters at Richmond, has

Richard Brooke

been promoted to assistant engineer maintenance of way to succeed Mr. Brooke. **M. I. Dunn, Jr.,** assistant division engineer of the Huntington division, at Huntington, W. Va., has been promoted to division engineer of that division at Huntington, to succeed **A. E. Botts,** whose promotion to general inspector of bridges and buildings is noted elsewhere in these columns. **R. L. Kittredge,** cost engineer on the Hocking Valley, has been appointed assistant division engineer of the Huntington division to succeed Mr. Dunn.

Mr. Brooke was born at Sutherlin, Va., and graduated from the Virginia Military Institute in 1908. He entered railway service on April 18, 1909, as a rodman on the Cumberland division of the Baltimore & Ohio and was transferred in turn to the New Castle and the Pittsburgh divisions. By successive promotions he became assistant division engineer of the latter division on June 6, 1912. He was assistant engineer on the Main Line division from February 2, 1916, to January 30, 1917, when he was transferred to the office of the engineer maintenance of way. He entered the United States Army on June 20, 1917, as a captain in the Fifteenth Engineers and was promoted to major on November 6, 1918. On his return to civil life on August 30, 1919, he re-entered the service of the B. & O. as division engineer of the Charleston division. He left the B. & O. on April 15, 1925, to make a study of and a report on the railway and port facilities of the Anglo-Chilean Nitrate Consolidated Corporation in South America and on the completion of this work on December 15 of the same year, was appointed special engineer in the office of the vice-president of operation of the Chesapeake & Ohio. He was promoted to assistant engineer maintenance of way, with headquarters at Richmond, in January, 1927, which position he was holding at the time of his promotion to engineer maintenance of way on April 15.

Mr. King was born at Barboursville, W. Va., on March 1, 1884, and entered railway service in September, 1900, as a carpenter on the C. & O. at Huntington, W. Va. He was subsequently promoted to building inspector, carpenter foreman, assistant engineer and supervisor of bridges, buildings and water supply until July 1, 1918, when he was promoted to division engineer, with headquarters at Hinton, W. Va. In July, 1925, Mr. King was promoted to general supervisor of bridges and buildings, with headquarters at Richmond, which position he was holding at the time of his recent promotion to assistant engineer maintenance of way on April 15.

Henry S. Loeffler, whose promotion to bridge engineer of the Great Northern, with headquarters at St. Paul, Minn., was noted in the April issue, was born on August 24, 1889, in Rock County, Minn., and was educated at the University of Minnesota, where he graduated in 1915. In April of the same year, Mr. Loffler entered railway service as a bridge inspector on the Northern Pacific, becoming a labora-

Henry S. Loeffler

tory assistant at the University of Minnesota later in 1915. In October, 1915, he entered the service of the Great Northern as an assistant engineer, serving in that position until March, 1918, when he entered war service as an assistant engineer with the United States Emergency Fleet Corporation. He returned to the Great Northern in April, 1918, as an assistant engineer on the lines between Williston, N. D., and Spokane, Wash., in which capacity he handled special design and construction work until his recent promotion to bridge engineer.

Track

George Daly, general foreman at the Meadville yard of the Erie, at Meadville, Pa., has been promoted to supervisor on Subdivision No. 1 of the New York, Susquehanna & Western (Erie), with headquarters at Paterson, N. J., succeeding **C. A. Joyce,** retired.

W. L. Spyres, roadmaster on the Kansas City Southern, with headquarters at Mena, Ark., has been transferred to Pittsburg, Kan., to succeed **J. W. Griffith,** who has been transferred to Hume, Mo., where he takes the place of **John Turman,** who, in turn, has been transferred to Mena to succeed Mr. Spyres.

Walter C. Peters has been appointed roadmaster on the Atchison, Topeka & Santa Fe, with headquarters at Abilene, Kan., to succeed **R. L. Grubb,** who has been transferred to El Dorado, Kan., to take the place of **N. Bridges,** who in turn has been transferred to Mulvane, Kan., succeeding **Morris Rowe,** who has retired.

P. B. Garrison, a member of the engineering corps on the River division of the New York Central with headquarters at Weehawken, N. J., has been promoted to assistant track supervisor on the Pennsylvania division at Jersey Shore, Pa., succeeding **Melvin Delaney,** whose death is noted elsewhere in these columns. **F. G. Smith,** division engineer of the Syracuse division of the New York Central, with headquarters at Syracuse, N. Y., has been appointed supervisor on the Pennsylvania division at Clearfield, Pa.

J. L. Nicholson has been appointed acting roadmaster on the Calgary division of the Canadian National, with headquarters at Big Valley, Alta., to succeed **T. A. Gallagher,** who has been transferred to Edson, Alta. **C. W. Palmer,** section foreman at Maccan, N. S., has been promoted to roadmaster on the Moncton division, with headquarters at Moncton, N. B., to succeed **T. McPherson,** who retired on April 1.

D. C. Gough, instrumentman on the Kamloops division of the Canadian Pacific, has been appointed acting roadmaster on the same division, with headquarters at Kamloops Junction, B. C., to succeed **M. M. Churchill,** whose promotion to acting division engineer is noted elsewhere in this issue. **H. Gunderson,** roadmaster on the Fraser subdivision, with headquarters at Smithers, B. C., has been transferred to the Okanagan subdivision at Kamloops Junction to succeed **A. F. Wilson,** transferred.

B. H. Briggs, formerly roadmaster on the Buffalo, Rochester & Pittsburgh, retired on March 1 after a service of almost 44 years in the maintenance of way department of that road. Mr. Briggs entered the employ of the B. R. & P. on August 21, 1885, as a section foreman at Punxsutawney, Pa., and was later promoted to extra gang foreman. In 1907 he was promoted to roadmaster with headquarters at Mt.

Jewett, Pa., later being transferred to Springville, N. Y., where he served in that capacity until 1921, following which time he was an inspector in the maintenance of way department.

Quin Baker, assistant engineer on the St. Louis-San Francisco, whose promotion to roadmaster, with headquarters at Sapulpa, Okla., was noted in the March issue, was born on October 18, 1894, at Welda, Kan., and was educated at the University of Kansas. After completing his college education, Mr. Baker entered the service of the Frisco on June 6, 1916, as a chainman in the district engineer's office at Springfield, Mo., where he was advanced to transitman. He was transferred to Sapulpa in March, 1920, and in 1922 was promoted to assistant engineer with the same headquarters, which position he was holding at the time of his recent promotion to roadmaster.

Harold C. Hayes, whose promotion to roadmaster on the Illinois Central, with headquarters at Clinton, Ill., was noted in the April issue, was born on August 1, 1887, at Bremen, Ind., and

Harold C. Hayes

educated at Purdue University, where he graduated in 1910. Mr. Hayes entered railway service on April 1, 1911, as a chainman in the construction department of the Illinois Central and was promoted successively to rodman and instrumentman until 1917, when he was further promoted to assistant engineer, serving in this capacity on the Louisiana and Memphis divisions as well as on grade reduction and construction work. He was promoted to assistant roadmaster of the Chicago Terminal division in February, 1925, which position he was holding at the time of his recent promotion to roadmaster.

W. Bryant, whose promotion to roadmaster on the Canadian National, with headquarters at Coalspur, Alta., was noted in the March issue, was born in England on September 7, 1882, and entered railway service on the Canadian Pacific on September 6, 1906. He was promoted to section foreman in May, 1908, and on November 1, 1913, entered the service of the Grand Trunk Pacific (now a part of the Canadian National) with which road he remained for five years. He was appointed roadmaster on the Alberta & Great Waterways in 1920, where he remained until that position was abolished on December 31, 1921. On May 22, 1922, he was made general foreman on the Canadian National and was holding that position at the time of his recent promotion to roadmaster.

P. C. Smedley, assistant supervisor on the New York division of the Pennsylvania, with headquarters at New York, has been promoted to supervisor on the Long Island, with headquarters at Hicksville, N. Y., succeeding **Joseph Summers,** who has been transferred to Jamaica, where he succeeds **R. L. Haring,** who has been assigned to special duty in the office of the chief engineer maintenance of way, New York zone, of the Pennsylvania, with headquarters at New York. **E. R. Wingfield, Jr.,** assistant on engineer corps on the New York division of the Pennsylvania, at New Brunswick, N. J., has been promoted to assistant supervisor on the Long, Island, at Jamaica, N. Y., succeeding **F. H. DeMoyer,** who has been promoted to supervisor on the Trenton division of the Pennsylvania, with headquarters at Jamesburg, N. J.

Changes on the Pennsylvania

F. G. Rettig, assistant on engineer corps on the Pittsburgh division of the Pennsylvania, has been promoted to assistant supervisor on the Buffalo division at Olean, N. Y., to succeed **Carl McGhee,** who has been transferred to the Eastern division at Wooster, Ohio, where he replaces **C. J. Henry,** who has been promoted to supervisor on the Allegheny division, Titusville, Pa., succeeding **M. J. Jones,** appointed chief draftsman on the Erie and Ashtabula division. **C. E. Ballard,** assistant on engineer corps on the Pittsburgh division, has been promoted to assistant supervisor on the Conemaugh division at Blairsville, Pa. **H. B. Russell,** assistant on engineer corps on the Eastern division, has been promoted to assistant supervisor on the Renovo division, at Erie, Pa., to succeed **T. F. Angus,** who has been transferred to the Pittsburgh division at Derry, Pa., where he replaces **H. E. Conklin,** who has been promoted to supervisor on the Akron division at Akron, Ohio, succeeding **J. L. Huron,** who has been transferred to the Pittsburgh division at Trafford, Pa., succeeding **F. H. Rothe,** whose promotion to assistant engineer in the office of the chief engineer maintenance of way of the Western region at Chicago is noted elsewhere in this issue. **C. R. Montgomery,** assistant supervisor on Allegheny division, has been transferred to the Pittsburgh division at Gallitzin, Pa., succeeding **F. A. Dever,** who has been promoted to supervisor on the Cleveland division, at Cleveland, Ohio, to succeed **W. E. Baker,** who has been transferred to the Panhandle division at Carnegie, Pa., where he takes the place of **H. R. Geib,** who has been transferred to the newly created position of supervisor on the Pittsburgh division at Pitcairn, Pa.

R. M. Herbert, assistant supervisor at Washington, D. C., has been promoted to supervisor at Millersburg, Pa., succeeding **E. L. McNeal,** who has been transferred to Lemoyne, Pa., where he succeeds **C. R. Bergman,** who has been transferred to Tyrone, Pa., replacing **M. J. Miller,** who has been transferred to the Columbia & Port Deposit branch. **L. C. Thornhill,** assistant supervisor at Williamsport, Pa., has been transferred to Harrisburg, Pa., where he succeeds **H. F. Webber,** who has been transferred to Washington, D. C., to succeed Mr. Herbert. **R. P. Hebard,** assistant on engineer corps at Middletown, Pa., has been promoted to assistant supervisor at Sunbury, Pa., to succeed **P. M. Roeper,** who has been transferred to Altoona, Pa., where he succeeds **H. H. Pevler,** who has been promoted to supervisor at York, Pa., succeeding **C. F. Trowbridge,** who has been transferred to Wilmington, Del., where he succeeds **R. G. Ford,** who, in turn, has been transferred to the Maryland division. **J. D. Morris,** assistant supervisor at Tyrone, Pa., has been promoted to supervisor at Harrington, Del., to succeed **Charles Weiss,** who has been transferred to the Fort Wayne division of the Western region, with headquarters at Valparaiso, Ind. **P. W. Triplett,** assistant supervisor at Lemoyne, Pa., has been transferred to the Middle division at Newport, N. J., where he succeeds **A. H. Whisler,** who has been transferred to West Philadelphia, Pa., succeeding **H. O. Gray** who has been promoted to supervisor at Elmira, N. Y., on the Elmira division. Mr. Gray succeeds **H. K. Lockhart,** who has been transferred to the Norfolk division at Cape Charles, Va. **W. R. Parvin,** supervisor on the New York division at Jersey City, N. J., has been transferred to Trenton, N. J.

Mr. Gray was born on June 3, 1903, at Passaic, N. J. He graduated from Rutgers University in 1925 and entered railway service with the Pennsylvania on October 11, 1926, as a rodman at Jersey City, N. J. Later in that same year he was transferred to New Brunswick, N. J., and in January, 1927, he was promoted to assistant supervisor at Clayton, Del. He later served in this capacity at Washington, D. C., Altoona and West Philadelphia, Pa., and was located at the latter point at the time of his recent promotion to supervisor at Elmira, N. Y.

Mr. Pevler was born on April 20, 1903, at Waynetown, Ind., and graduated from Purdue University in 1927. He entered railway service with the Pennsylvania on July 10, 1927, and on November 1 of the same year was promoted to assistant supervisor at Camden, N. J. In September, 1928, he was transferred to Altoona, Pa., where he was located at the time of his recent promotion to supervisor.

Mr. Morris was born on December 7, 1905, at Baltimore, Md., and graduated from the University of Maryland in

1926. On June 14 of the same year he entered the service of the Pennsylvania as a rodman on the Pittsburgh division at East Liberty, Pa., and in February, 1927, he was promoted to assistant on engineer corps at Washington, D. C. In the following April, he was promoted to assistant supervisor at Hollidaysburg, Pa., and subsequently served in this capacity at Jersey City, N. J., Downington, Pa., and Tyrone.

Bridge and Building

W. Z. Gahman, carpenter foreman on the Pittsburgh division of the Pennsylvania, has been promoted to assistant master carpenter on the same division.

William Reilly, bridge and building foreman on the Dubuque division of the Chicago, Milwaukee, St. Paul & Pacific, has been promoted to chief carpenter of the Madison division, with headquarters at Madison, Wis.

J. L. McAllister, bridge and building foreman on the Saguenay division of the Canadian National, has been promoted to bridge and building master on the Cochrane division, with headquarters at Cochrane, Ont., succeeding **P. Lizotte,** transferred.

A. E. Botts, division engineer of the Huntington division of the Chesapeake & Ohio, with headquarters at Huntington, W. Va., has been promoted to general supervisor of bridges and buildings, with headquarters at Richmond, Va., to succeed **J. E. King,** whose promotion to assistant engineer maintenance of way is noted elsewhere in these columns.

W. F. Bucknell, master carpenter of the Creston division of the Chicago, Burlington & Quincy, with headquarters at Creston, Iowa, has been promoted to supervisor of bridges of the lines west of the Missouri river, with headquarters at Lincoln, Neb., to succeed **E. M. Anderson,** notice of whose death will be found elsewhere in this issue. **W. B. Bonnefield,** assistant master carpenter on the Ottumwa division, has been promoted to master carpenter to succeed Mr. Bucknell at Creston and **Ellis Moore,** bridge foreman on the Centerville division, has been promoted to assistant master carpenter on the Ottumwa division to succeed Mr. Bonnefield.

Purchasing and Stores

C. H. Vandegrift has been appointed division storekeeper on the Albuquerque division of the Atchison, Topeka & Santa Fe at Gallup, N. M., succeeding **A. M. McHenry,** who has been transferred to Winslow, Ariz.

F. C. Riley, traveling storekeeper and maintenance inspector on the Chicago & Alton, has been promoted to assistant general storekeeper, with headquarters at Bloomington, Ill., succeeding **E. L. Murphy,** who has resigned to enter the service of another company.

J. C. Hart, chief clerk to the division storekeeper of the Chicago, Milwaukee, St. Paul & Pacific at Minneapolis, Minn., has been promoted to division storekeeper of the Iowa & Dakota and the Southern Minnesota divisions with headquarters at Mason City, Iowa. **Harry L. Stamp,** local storekeeper at Harlowtown, Mont., has been promoted to division storekeeper, with headquarters at Mobridge, S. D., to succeed **F. J. Kratschmar,** resigned. **E. F. Grisius** has been appointed division storekeeper of the Sioux City and Dakota division with headquarters at Sioux City, Iowa, succeeding **G. F. Lake,** resigned.

Obituary

J. O. Johnson, retired roadmaster on the Southern Pacific, died at Portland, Ore., on February 25, aged 87 years.

Melvin Delaney, assistant supervisor of track on subdivision 25 of the Pennsylvania division of the New York Central, with headquarters at Jersey Shore, Pa., died on March 2, 1929.

John Osborn Ely, formerly roadmaster on the Louisville & Nashville, was killed in an automobile accident in Alabama on February 8 while engaged in work with the highway department of that state.

E. M. Anderson, supervisor of bridges of the Chicago, Burlington & Quincy, Lines West of the Missouri river, with headquarters at Lincoln, Neb., died at his home in that city on February 13.

John Herrell, who was supervisor on the Birmingham division of the Louisville & Nashville, with headquarters at Cullman, Ala., at the time of his retirement on January 1, 1926, died in that city on February 23, after a lingering illness. Mr. Herrell was 78 years old and at the time of his retirement had been in the service of the L. & N. for more than 48 years.

John W. Stevens, division engineer on the New York Central, with headquarters at Weehawken, N. J., died at his home in Jersey City, N. J., on April 8. Mr. Stevens was born on September 12, 1881 at Utica, N. Y., and was educated at Lafayette College. He entered the service of the New York Central on August 23, 1905, as a chainman at Utica, and was promoted successively to transitman and bridge inspector at that point. He was promoted to assistant track supervisor at Batavia, N. Y., on November 14, 1909, and on August 1, 1916, was further promoted to supervisor at Clearfield, Pa. On June 16, 1918, he was promoted to division engineer at Rochester, N. Y., and on October 1, 1927, he was transferred to Weehawken, N. J., where he was located at the time of his death.

William Carey Hattan, chief engineer of the Clinchfield, with headquarters at Erwin, Tenn., died in that city on March 25 from complications following an operation for appendicitis. Mr. Hattan was born on December 15, 1875, at Kerrs Creek, Va., and was educated at Washington & Lee university. Following his graduation in 1899, he entered railway service as a rodman on the West Virginia Short Line (now a part of the Baltimore & Ohio), later being advanced to inspector of materials and then to masonry inspector. In 1901, he became a masonry inspector on the Pennsylvania and later in the same year was employed in private practice. He re-entered railway service as a resident engineer on the Ozark & Cherokee Central (now a part of the St. Louis-San Francisco) and later was assistant engineer and resident engineer on location and construction on the Chesapeake & Ohio, the Western Maryland and the Carolina, Clinchfield & Ohio (now the Clinchfield). In 1910, Mr. Hattan again left railway service to engage in construction work and private practice until 1920, when he was appointed chief engineer of the Clinchfield, which position he was holding at the time of his death.

Harvey Cullen Estep, who served as a locating and construction engineer on several of the northerly transcontinental lines, died of heart failure at Long Beach, Cal., on March 20. After graduating from the University of Illinois in 1874, Mr. Estep was engaged in location surveys for the Oregon Railroad

Harvey Cullen Estep

& Navigation Company (now a part of the Union Pacific System) for a short time, following which he was in charge of exploration and location surveys for the Northern Pacific between Missoula, Mont., and Spokane, Wash. He was resident engineer on the construction of that road through the Cascade mountains in 1885 and 1886, and later was engaged in the construction of the terminals at Seattle, Wash. During 1898, he was division engineer on the construction of the Astoria & Columbia river (now a part of the Spokane, Portland & Seattle) and then became principal assistant engineer on the Minneapolis & St. Louis. From 1905 to 1908, he was division engineer in charge of location and construction on the Chicago, Milwaukee, St. Paul & Pacific and in 1910 was appointed chief engineer of the Southern New England, a subsidiary of the Grand Trunk, following which he retired from active railway work.

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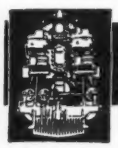

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By W. F. Rench

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1. The Relining of Curves with a String.
2. Preliminary Study of the Curve.
3. The Solution of String Lining Problems.
4. Superelevation of Curves.
5. The Spiral.
6. The Vertical Curve.
7. Economics of Curves.
8. Essential Elements in the Design of Switch Connections.
9. Rules for Computing Switch Dimensions.
10. Rules for Various Functions of Turnouts.
11. Practical Considerations in Installing Turnouts.
12. Methods in Installing and Maintaining Switches.
13. Simplified Field Work.
14. Special Practice.

Unloads Quickly in Ditcher Service

MAGOR Automatic Air Dump Cars perform excellently in ditcher service. Unloading is instantaneous and complete. These are necessary features when working between train times on main lines. Quick "get-aways" so vitally important in preventing traffic delays are obtained because these cars dump quickly to either side without time killing adjustments. They attain a 50° angle in full dumped position thereby assuring complete discharge of all loads clear of track ballast leaving a clear track for safe transportation.

Magor Car Corporation
50 Church St., New York

MAGOR *Automatic Air Dump* CARS

The Story the Picture Tells

THE accompanying view shows clearly what happens to both passenger and freight equipment when rounding curves like this one.

It makes plain the first reason and the last reason for Mexican Graphite Curve Grease.

This lubricant protects wheels and rails when applied to curves, and, in spite of weather of all kinds, continues to retain its usefulness when other lubricants are no longer serviceable. A free trial for the asking. Send for it.

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Mexican Graphite Products
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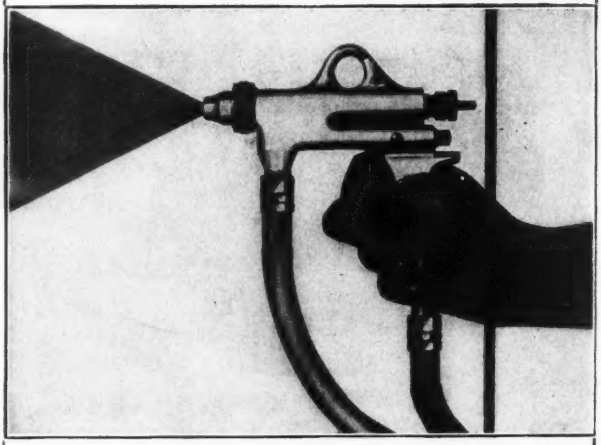
Eclipse G-3 Spray Gun

Makes Even ECLIPSE Painting Easier



ECLIPSE Low Pressure Spray Painting Equipment has for 21 years shown its superiority over all other painting and finishing methods.

Eclipse has always kept pace with new developments in painting and finishing procedure by improvements in design and performance which have won the approval of discriminating paint gun users.

The Internal-Mix, *Patented* Fan Slot Nozzle, combined with Eclipse Low Pressure Operation, has provided faster, cleaner, better results, more uniform covering and greater saving of time and materials.

Now three notable refinements are offered in this new G-3 Eclipse Gun.

Simpler Construction—
Complete take-down in ½ minute.

Direct Access Air Ports—
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Non-fatiguing, effortless spraying.

The new features enhance even proven Eclipse value. Find out more about them by using the coupon below.

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Established 1908

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Kindly send your catalog No. 30, illustrating and describing Eclipse Air Brush Equipment.

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Address_____

STATEMENT of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of *Railway Engineering and Maintenance*, published monthly at Chicago, Ill., for April 1, 1929.

State of New York }
County of New York } ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared J. T. DeMott, who, having been duly sworn according to law, deposes and says that he is the Treasurer of the Publisher of *Railway Engineering and Maintenance*, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Simmons-Boardman Publishing Company and Simmons-Boardman Publishing Corporation, both of 30 Church St., New York, N. Y.

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J. T. DeMott,
Treasurer.

Sworn to and subscribed before me this 26 day of March, 1929.

[SEAL] H. D. Nelson,

(My commission expires March 30, 1931.)

RUTS—HOLES—BROKEN-OUT PLACES

IN CONCRETE FLOORS AND ON STATION PLATFORMS AND HOW THEY AFFECT MEN, MERCHANDISE, TRUCKING EFFICIENCY AND EQUIPMENT

Because of the lack of knowledge of quick and efficient floor-repair methods, tremendous sums are paid out by railroads in damages caused by upsetting of trucks and subsequent breakage of merchandise.

Old fashioned methods for repairing ruts, holes and broken-out places, and resurfacing entire areas, were not only unsatisfactory, but required much preliminary preparation, and were so great a problem that concrete floors were permitted to remain in use until it was necessary to install a new floor.

STONHARD RESURFACER

has economically and satisfactorily overcome this problem in numerous railroads, such as, The Pennsylvania System, New York Central Railroad Co., New York, New Haven and Hartford Railroad Co., Chicago and Northwestern Railway Co., The Wabash Railway Co., and Chicago, Burlington and Quincy Railroad Co.

Send for our booklet, "Over the Rough Spots." It's free, and tells about America's Most Popular Floor Repair and Resurfacing Material.

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Canal and Poplar Streets, Philadelphia, Pa.

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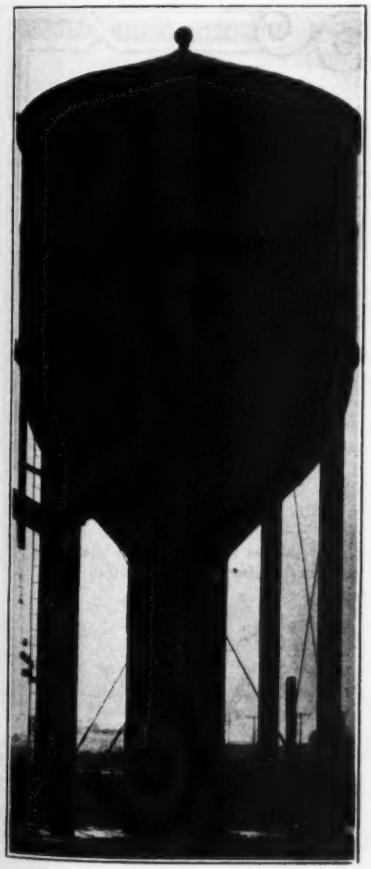


Reliable Protection for Tanks

These three tanks are typical of many all over the country coated with NO-OX-ID.

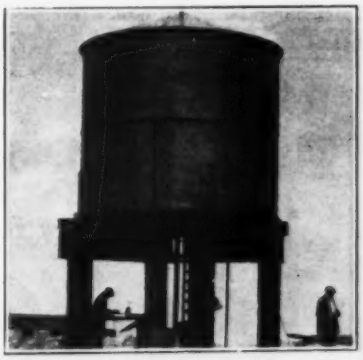
The upper right hand picture is a tank "on top of the world" at the top of Pikes Peak owned by the Cog Wheel Railroad, coated inside and outside. The water is used for engines and for domestic purposes. Inspection after the severe mountain winter showed the tank perfectly protected and the covering of NO-OX-ID intact. NO-OX-ID is applied easily, is absolutely reliable and makes a handsome job.

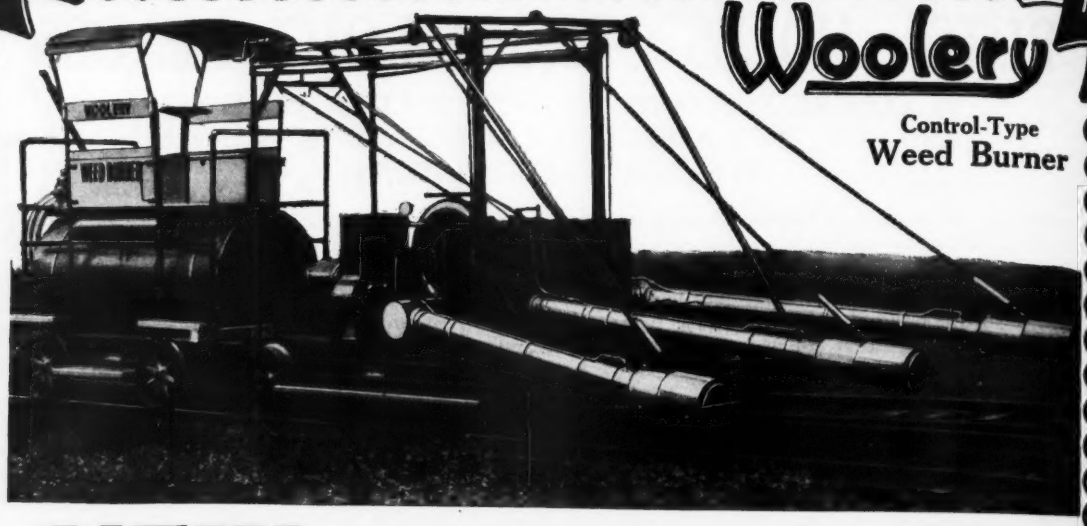
The tank at the left, however, was coated with NO-OX-ID and painted over with the railroad's standard black graphite paint. The paint was not necessary from the standpoint of protection but simply for the black color. 116 Railroads use NO-OX-ID. Serviced by experienced Dearborn men.

Dearborn Chemical Company

310 S. Michigan Avenue, Chicago
205 East 42nd Street, New York
Canadian Factory and Offices: 2454-2464 Dundas St. W., Toronto

NO·OX·ID
IRON-OX-RUST
TRADE MARK
The Original Rust Preventive





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NEW Performance and Low Cost

Last season proved the success of the NEW Woolery Weed Burning Method. Burner-heads at the end of long, movable air-tubes place the fire when and where needed. Old ideas of performance now obsolete.

New burner-heads eliminate maintenance expense. Three-burner machine burns 15 feet wide—five-burner machine burns 25 feet wide. Outside burners can be swung out to burn 35 feet wide, even in ditches.

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Woolery Machine Company, 2913 Como Ave., S. E., Minneapolis, Minn.

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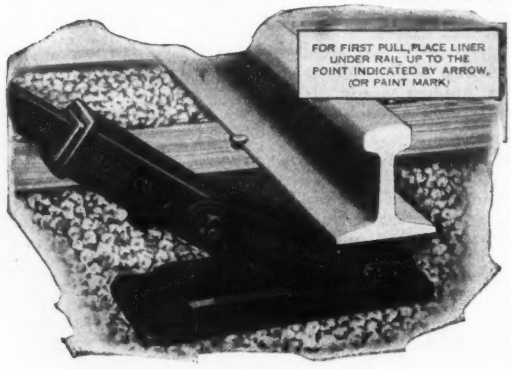
BUDA-CLARK Track Liners

Pay for Themselves in One Day's Lining

(Send for Facts and Figures)



Slides the track without lifting it.

More and Better Lining with Less Men

Lines track in any ballast.

Easily handled—weight 28 pounds.

Special tools unnecessary—the square socket fits standard lining bar.

Flat base without lugs makes liner easy to place in position.

An important feature is the small amount of lift necessary before the transverse movement takes place.

The forward movement comes from a lift on the lining bar, which is always safer and more effective than a downward pull.

Send for New Bulletin No. 675

THE BUDA COMPANY

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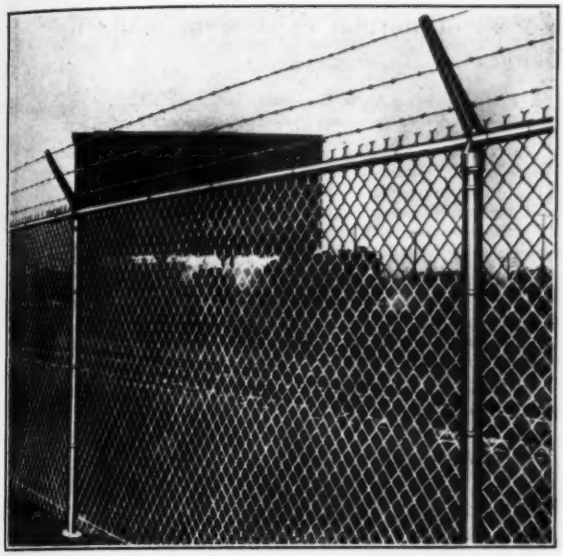
The high cost of 2 doing without 2-way protection



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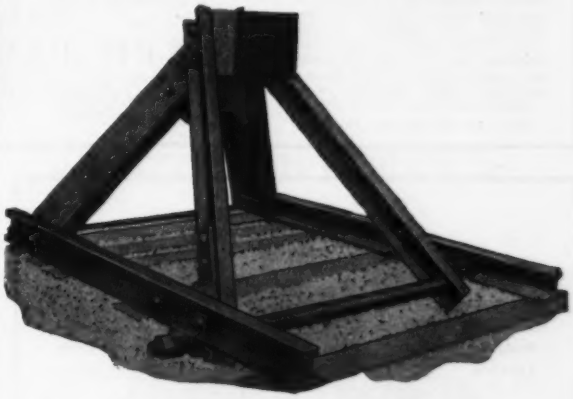
There is a definite purpose for a Bumping Post. No other reason for it than to stop cars at the end of a track, stub, or siding—thereby saving damage to persons or property.

The cost of this insurance can be kept down by using the new

DURABLE MODEL "B"



Model "B" is built-like all previous "Durables"—to "stop all cars," including the newest, heaviest 1929 rolling stock. We have proved and customers have proved, by actual tests, that they do stop the cars. In addition to being made stronger Model "B" has been made quicker, easier, less expensive, to install.

There are only a few holes to drill in the running rails, all parts are drilled and fitted at the factory, and there is not a hole to dig.

In other words, although Model "B" is built to maintain the DURABLE standard "DURABLE POSTS Stop all cars" it also reduces maintenance of way expense.

Write for Bulletin 20 "B."

The Mechanical Manufacturing Co.

Union Stock Yards, Chicago, Illinois

DIXON'S INDUSTRIAL PAINTS for sixty-five years known as Dixon's Silica-Graphite have had the unqualified approval of industrial and railroad institutions, bridge builders, architects, engineers, etc. For use on metal and wood surfaces of all kinds; factories, public buildings municipal upkeep, bridges, etc.

Made in 14 standard colors.

Announcement of important changes

The Joseph Dixon Company, for over sixty-five years recognized as a leader in the manufacture of high grade protective paints, have, in the process of normal expansion, made the following important changes . . .

DIXON'S INDUSTRIAL PAINTS have been increased in range of colors from eight to fourteen, meeting in a most complete way all standard color requirements in metal and wood protective coatings.

DIXON'S BRIGHT ALUMINUM contains a most durable spar varnish as its vehicle, giving great resistance to the elements, insuring the life and brilliance of the aluminum pigment. *There is no precipitation of pigment.* For bicycle rims or exterior plant maintenance and the many uses between. The standard six gallon case contains quarts, pints and half pints.

These changes represent many months of laboratory work, conferences with plant engineers, chemists and practical men and are directly traceable to pressure brought to bear by many hundreds of Dixon users and dealers during the past ten years.

Keeping in mind the quality of these paints and the reputation of the name, Dixon, we present them for your consideration.

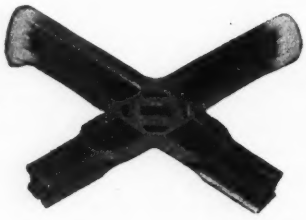
PAINT SALES DIVISION

JOSEPH DIXON CRUCIBLE COMPANY

JERSEY CITY, N. J.

Established 1827

New Scientifically Designed Crossing



Patented July 6, 1926

If you have not given this new construction a trial we know it would be to your advantage to purchase this type for points of severe service.

Beside crossings and other standard trackwork, the Wharton Plant is recognized headquarters for mitre and expansion rails for bridges, which require extreme care in machining and assembling.

WM. WHARTON JR. & CO., INC.

EASTON, PENNA.

RELIEF FROM INSECTS

Insects meet their Waterloo when they encounter the gas liberated from RAILROAD CALCYANIDE.

The clothes moth, in its haunts among articles of clothing and upholstery, is brought to an abrupt end in its damaging and destructive tendencies; the bedbug, in its smug seclusion among blankets, bed springs and mattresses, fails to survive and enjoy another feast of human blood, with the attendant misery, suffering, loss of sleep and impaired efficiency on the part of its human prey; the elusive cockroach, in the pantry cupboard and other hiding places in the kitchen, no longer spoils the appetite of diners by its presence and stench. All other insects and rats and mice are just as easily destroyed.

For three years this GREATEST OF ALL FUMIGANTS has been winning its way into the hearts of railroad men, because of its remarkable effectiveness in destroying these pests in bunk houses, cabooses, outfit cars, commissaries, dining cars, sleeping cars, lunchrooms, restaurants, club houses, store rooms, section houses, ferry boats and other railroad structures.

A 2-lb. or 3-lb. can of RAILROAD CALCYANIDE will provide you with sufficient of this product to conduct a trial fumigation. The results will prove a revelation.

Descriptive booklet upon request

Calcyanide Company

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The long wear that railroads appreciate

Because of their unusual durability Genasco Asphaltic Protective Products are extensively used by the leading railway systems throughout the United States. Here's a list of Genasco products—check those about which you'd like to have full information, and write us.

Genasco Ready Roofings (Smooth and Slate Surface)
Genasco Sealbac Shingles (Individual and Strip)
Genasco Latite Shingles
Genasco Standard Trinidad Built-up Roofing
Genasco Membrane Waterproofing
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Genasco Waterproofing Felts
Genasco Waterproofing Fabric
Genasco Asphalt Pipe Coating
Genasco Asphalt Mastic
Genasco Asphalt Fibre Coating
Genasco Roof Coating
Genasco Industrial Paint
Genasco Concrete Primer
Genasco Elastic Boiler Cement
Genasco Trinidad Lake Roofing Asphalts
Genasco Battery Seal Asphalt
Genasco Battery Paint
Genasco Asphalt Putty
Genasco Acid-Proof Paint
Genasco Asphalt Saturated Felt
Genasco Crack Filler
Genasco Deadening Felt
Genasco Insulating Paper
Genasco Red Sheathing Paper
Genasco Stringed Felt
Genasco Wall Lining
Curcrete, an asphalt emulsion for curing concrete
Barber Brand Cold Repair Cement (for crossings more permanent than wooden planks and for platform construction)
Genasco Acid-Proof Mastic
Genasco Insulating Asphalt (for use in Box Car Construction)
Genasco CRC Damp-Proofing (for use on abutments, walls, cellars, etc.)

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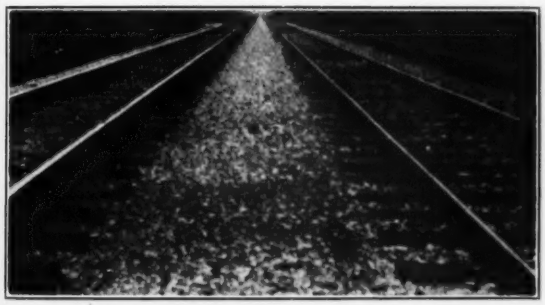

HOW MANY IN 1929?

Every railroad consistently using Pressure Creosoted ties reports a decrease in annual number of replacements per mile.

Because they offer the maximum service life with minimum maintenance cost, National Pressure Creosoted Cross and Switch Ties are today used on more than a dozen of the Country's great trunk lines.

National Lumber & Creosoting Company

GENERAL OFFICES: Texarkana, Ark.

PLANTS: Texarkana, Tex.; Houston, Tex.; Kansas City, Mo.; Salida, Colo.; Alexandria, La.; Columbia Park (Finney), O.; Denver, Colo.; and Superior, Wis.

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ABSOLUTE dependability, striking economy and a wide range of adaptability combine to make Pomona Pumps preferred equipment. A large number of railroads are finding that they render unsurpassed service in supplying water.

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DOUBLE STROKE DEEP WELL POWER PUMP

Pomona Pumps are better because they are designed and built to give a long life of dependable efficient service. The reciprocating stroke which eliminates all dead weight, effects remarkable power saving. The extreme simplicity and ruggedness minimizes maintenance costs. We will gladly show you what The Pomona is doing in present railway installations. Write.

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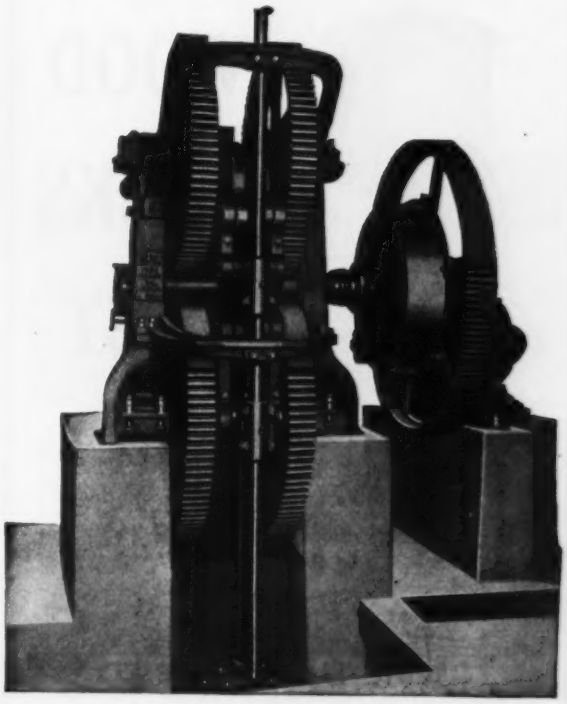
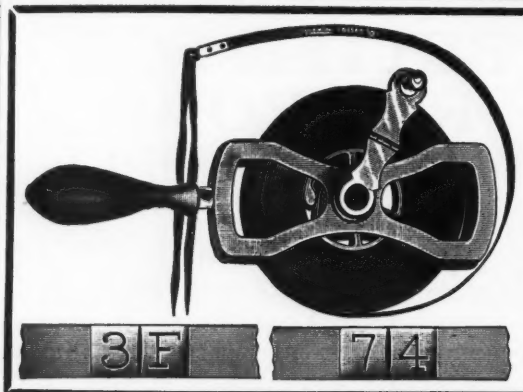


"UNITED" IRON WORKS INC. FOR SERVICE



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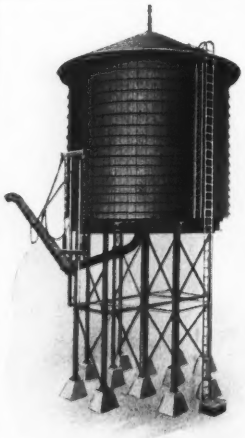

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THE STANDARD SINCE '88

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String Lining of Curves Made Easy

By Charles H. Bartlett

THE articles on the above subject which appeared in Railway Engineering and Maintenance from January to July, 1928, have been reprinted in pamphlet form.

They Show You How to Make Accurate Curve Adjustment

without engineering instruments or other appliances except a string and a rule.

This is a manual which gives a method of easily checking and correcting curve alinement with tools always at hand.

The method is entirely practical, having been developed by the author in the actual work of lining curves on an important road.

Yours for Fifty Cents

Railway Engineering and Maintenance
105 West Adams St., Chicago

MORE THAN 1/2 OF THE RAILROAD MILEAGE of the UNITED STATES is being laid with RAILS made under

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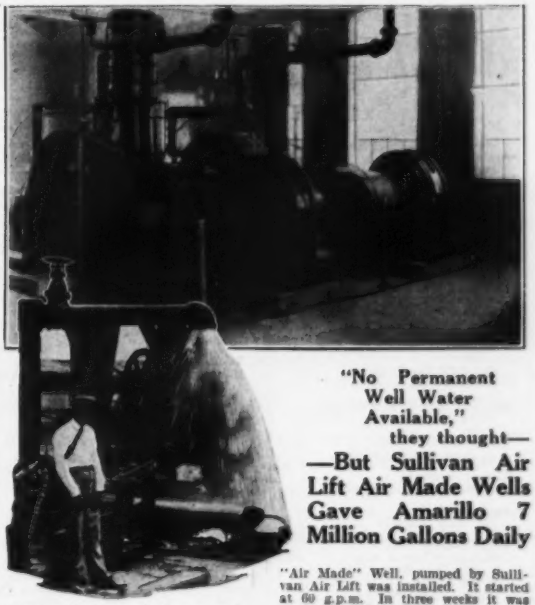
Special H Inspection

Robert W. Hunt Company
Engineers
22nd. Floor Insurance Exchange
Chicago



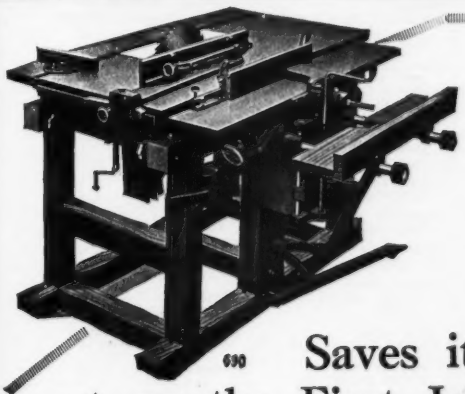
"No Permanent Well Water Available," they thought—

—But Sullivan Air Lift Air Made Wells Gave Amarillo 7 Million Gallons Daily

Amarillo, Texas, needed more water. A 25-foot bed of fine quicksand, saturated with water offered the only source of supply. It lay 145 feet from the surface.
But wells previously drilled in the canyon had failed. Sand clogged the screens. The wells fell off to less than 90 g.p.m. Where the sand was pumped out—the overlying clay caved into the wells.
Nobody thought the sand strata of Palo Duro Canyon could yield a permanent water supply. But a 20-in. "Air Made" Well, pumped by Sullivan Air Lift was installed. It started at 60 g.p.m. In three weeks it was producing 700 g.p.m.
The "Air Made" Well process removed the sand and inserted coarse gravel. Nine more "Air Made" Wells were installed. Their daily capacity is seven million gallons.
Sullivan Air Lift has solved many water problems. If your wells slow up—if you are interested in a water system that has no moving parts in the well to need inspection or repair—investigate modern Sullivan Air Lift.

Send for booklets

SULLIVAN MACHINERY COMPANY
708 Wrigley Bldg., Chicago



690

Saves its cost on the First Job

This American Portable Variety Woodworker lets you do any woodworking operation of either a routine or special nature right on the job. Figure the saving over hand or shop work! Hundreds are now in use.

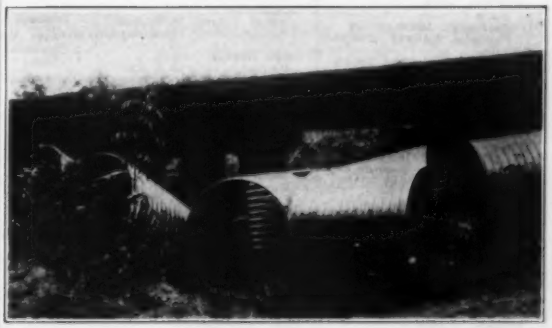
This one machine may be used as a rip or cut-off saw, as a dado, gaining, grooving, rabbiting, tenoning or boring machine, as a jointer or planer, a matcher, molder or sander and as a hollow chisel mortiser.

Let us send you our Bulletin No. 82 describing our full line of Woodworking Machines for use on the job or in the shop.

– See –
Railway Engineering and Maintenance 1926 Cyclopedia Edition for detailed information

Amercian Saw Mill Machinery Co.
164 Main Street, Hackettstown, N. J.
"American" Saw Mills and Woodworkers

SPI-COR
Cast Iron Spiral Corrugated Culvert Pipe



For Replacing Wooden Trestles

rethreading old culverts, out-of-the-ordinary and hard to handle installations; for general maintenance work and new construction. SPI-COR cast iron culvert pipe offers an economical and permanent solution of many problems that come up in handling the drainage.

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Assistant Engineer, Engineering Department, Southern Pacific Company

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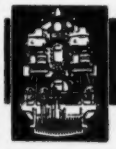

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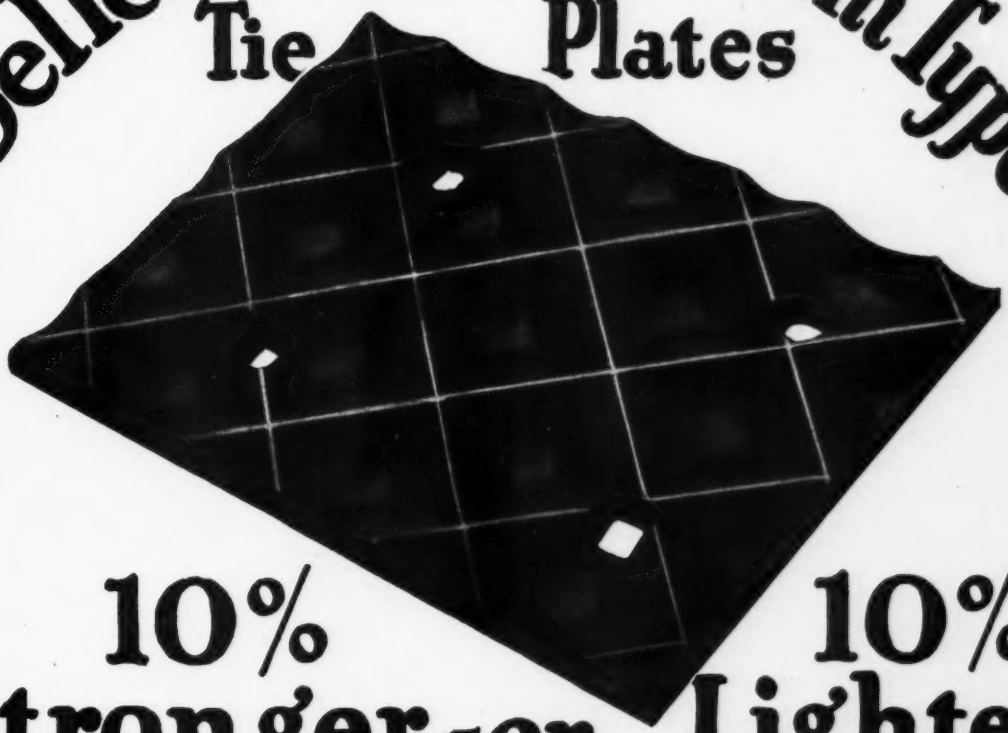

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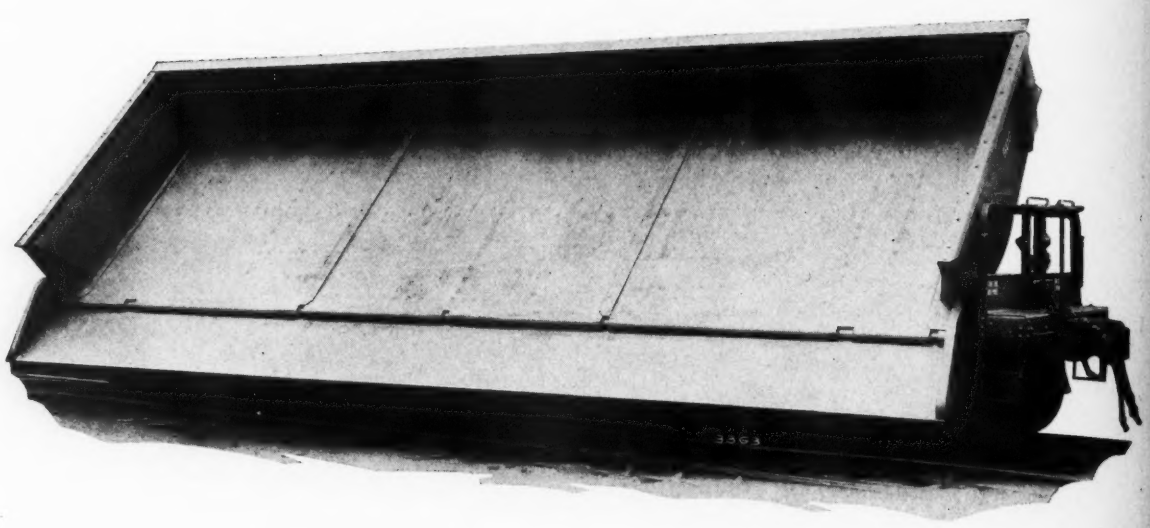

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